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MEINECKE (E. P.). **Pathology of quaking Aspen in Utah in relation to regulation.**—Abs. in *Phytopath.*, xii, 9, p. 446, 1922.

The possibility of utilizing quaking aspen [*Populus tremula*] for pulp in Utah, where it is common, depends largely on the control of wood decay, chiefly caused by *Fomes igniarius*. About 50 per cent. of all wounds become infected, fire being an important predisposing cause.

MANGIN (L.) & PATOUILLARD (N.). **Sur la destruction de charpentes au château de Versailles par le Phellinus cryptarum Karst.** [On the rotting of the timberwork in the palace of Versailles by *Phellinus cryptarum* Karst.]—*Comptes Rendus Acad. des Sciences*, clxxv, 9, pp. 389–394, 4 figs., 1922.

The chief part in the decay of the oak beams in the roof of the old Louis XIII wing of the palace of Versailles, of which so much has been heard recently, is played by the fungus *Phellinus cryptarum* Karst. (syn. *Polyporus* [*Fomes*] *cryptarum* Fr.; *P. undatus* Pers.; *Boletus cryptarum* Bull.). Exceptionally favourable conditions for its development are supplied by the fact that the oak beams have been covered with plaster having an outer air-tight coating which prevents air and light from reaching the wood. The attacked timbers, especially the ends embedded in the masonry, are reduced almost to the consistency of lint, leaving long, fibrous strands extending lengthwise in the beams. The decayed wood is easily crushed together by slight pressure, but does not crumble to powder as in the case of wood destroyed by *Merulius lacrymans*. All the elements of the wood, with the exception of the long, fibrous strands (which consist of still lignified membranes occupying the angles of the cells) and a few transverse bands of tissue (also with intact membranes), which loosely join them together, are reduced to shreds from which the lignin bodies and pecto-celluloses have disappeared. In the portions of the beams bordering on the still sound parts, the initial stages of the rotting could be observed.

One of the most remarkable features of the decay, noted also, but not so constantly, in timber attacked by *Ungulina annosa* [*Fomes annosus*], consisted in the complete dissolution of the membrane limiting the bordered pits of the invaded cells; the walls of the cells thus appeared riddled with holes long before the rest of the cell wall was dissolved. In many cases the bordered pits thus set free were so abundant in the mounting medium of the sections that they were at first mistaken for accumulations of spores. Medullary rays resist the dissolving action of the fungus longer, and appear as broad laminae in the midst of the decayed tissues.

The attacked cells were invaded by numerous widely and irregularly branching hyphae without clamp-connexions, 0·5 to 2 or 3 μ thick, which formed an abundant and loose mycelial felt in the partly destroyed vessels and in cracks in the wood. Perfect fructifications of the fungus, a full description of which is given, appear in the form of more or less orbicular plates, up to 20 cm. in diameter, attached to the substratum by one central point, or by several points in cases where several fructifications have coalesced. Besides this normal form, specimens are often found reduced to a simple, smooth or undulated membrane, easily detachable from the substratum and bearing none of the characteristics of a fruit-body. The fungus has no cystidia, and the authors did not succeed in finding spores. In very wet conditions the fungus exudes numerous droplets of liquid which, on drying, leave irregularly-dispersed, black spots on its surface.

Phellinus cryptarum is generally found in cellars and mines, and is common in damp, dark, and non-aerated places; the authors are not aware of its having been previously recorded as destroying woodwork in buildings. It has been identified with *Fomes annosus* by some authors, but differs from the latter both in its fructifications and in the nature of the wood decay it causes. Montagne wrongly identified as *Phellinus cryptarum* another fungus *Leptoporus* [*Fomes*] *rufo-flavus* B. & C. which is not uncommon in greenhouses, mines, &c., and which has also been described by Rabenhorst as *Polyporus braunii*. Quite recently another case of the rotting of oak beams supporting the ceiling of a room, kept closed for fifteen years, in a school near Etampes, has been examined by the authors and found to be due to *Phellinus cryptarum*. They consider this fungus therefore as a dangerous wood destroyer, but believe that good ventilation and dryness are sufficient to check its development.

A certain number of the beams examined at Versailles were worm-eaten, the insects concerned being chiefly *Xestobium rufovillosum* Deg. and (less often) *Anobium domesticum* Geoffr.

Levy (E. B.). **Investigation of dry rot of Swedes.**—*New Zealand Journ. of Agric.*, xxiv, 6, pp. 336–343, 6 figs., 1922.

The investigation of the dry rot disease of swedes (*Phoma napobrassicae*) during 1920–21 was mainly directed towards soil sterilization, it having been conclusively demonstrated that the organism overwinters in the soil. The trials were conducted as follows, the quantities being calculated to the acre and the material broadcasted on the ploughed surface in all the treated plots except

15, 16, and 18. Plot 1, control; plot 2, burnt lime, 2 tons; plot 3, burnt lime, 8 tons; plot 4, burnt lime, 4 tons; plot 5, control; plot 6, sulphur, 3 cwt.; plot 7, sulphur, 9 cwt.; plot 8, control; plot 9, copper sulphate, 3 cwt.; plot 10, copper sulphate, 9 cwt.; plot 11, control; plot 12, iron sulphate, 3 cwt.; plot 13, iron sulphate, 9 cwt.; plot 14, control; plot 15, formalin, 1 pint to 30 sq. yds.; plot 16, carbon bisulphide, 1 pint to 30 sq. yds.; plot 17, control; plot 18, Bordeaux mixture 4–6–40, 1 gall. to 2 sq. yds. The best results were got on plots 6 and 18, all the others giving over 50 per cent. dry rot after 5 months except plots 13 and 14, which had over 40 per cent., plot 17 over 30 per cent., and plot 10 where there was a serious reduction of germination and about 25 per cent. rot. Even in plots 6 and 18 control was inadequate, and the method cannot be recommended for farm practice. The tests were carried out on land which had carried two consecutive swede crops, the second being rather severely attacked by the disease. A similar series of tests was repeated on adjoining land not previously in swedes, and here the percentage of infection, taking the series as a whole, was only 12, as against 56 per cent. in the field previously in swedes, the division at the junction of diseased and healthy land being quite sharply marked. This 12 per cent. of infection may have been due to a slight attack of dry rot on a crop of soft turnips grown on the same area two years earlier. The infection on the land not previously in swedes was definitely patchy, the remainder of the crop being fairly sound, while on the corresponding area previously in swedes there was infection throughout. Infection likely to have arisen from seed-borne spores was rare.

It is apparent from these results that the organism overwinters in the soil, and forms more or less numerous centres of infection which may involve the whole crop. The subsequent spread is certainly wind-borne, but the radius of infection is quite short, the patches rarely exceeding 20 ft. in diameter. Attempts were made to reduce the secondary wind-borne infection by growing the roots close together to form a denser leaf-cover, and also by interplanting thousand-headed kale with the swedes. The latter method proved very successful, the kale lasting well and affording considerable protection to the swedes. Such preventive measures, however, are only effective in reducing secondary wind-borne infection, and are of no use against the primary or seedling stage of the disease.

A suitable type of crop rotation appears to be the only reliable means of control, and suggestions for a six years' course are given.

PAINE (S. G.) & LACEY (MARGARET S.). **Chocolate spot disease or streak disease of Broad Beans.**—*Journ. Min. Agric.*, XXIX, 2, pp. 175–177, 1 fig., 1922.

The causal organism of the chocolate spot or streak disease of broad beans is *Bacillus lathyri* Manns and Taub., which causes streak in sweet peas and stripe in tomatoes, and is known to attack many leguminous plants. It is considered probable that field beans are seldom, if ever, entirely free from this disease, but serious outbreaks occur only under exceptional weather conditions, as in the summer of 1920 for instance, when a heavy epidemic throughout

a large part of England and Wales was preceded in many places by hot, wet, and thundery weather. In 1921, on the other hand, the exceptionally dry weather soon checked the disease which made its appearance in the early spring; the plants quickly recovered from the attack, and a month later showed no sign of injury.

In a typical case described, the first symptoms of the disease—small, purplish-brown spots on the leaves and long or short streaks of a rich bronze colour on the stems—appeared in the last week of May 1920 on beans planted in October 1919: at the end of the first week in June the plants were largely defoliated, the remaining leaves showing a good deal of blackening. About the middle of July the stems in the central portion of the field were beaten down by rain, all the leaves had been shed except a bunch at the top of the stalks, and the whole plants were being rapidly rotted by a *Botrytis* which, in all cases observed, followed closely after the streak disease. In many instances the plants on the borders of the field were less severely attacked, the conditions in the outer, more exposed, portions being drier than in the centre and less favourable to the spread of the disease. During 1920 the epidemic spread apparently from west to east, and this observation seems to suggest wind dispersal of the causative organism, which may find entry into the host through the stomata of the leaves. There is also evidence that the organism is carried on the seed of winter beans, and especially on those which have been bored by the bean beetle *Bruchus rufimanus*: the plants may be inoculated by this beetle when laying its eggs, and the young larvae which develop in the pod may infect the seed when boring their way in.

The authors suggest as a possible means of control, the application to land on which the disease has occurred to a serious extent of a good dressing of potash, since it is known that this treatment has been successful in checking stripe in tomatoes. The seed should be carefully examined and rejected if showing an excessive amount of boring by beetles; before sowing it should be soaked for ten minutes in weak lysol or formalin, or dressed with one of the tarry preparations supplied for seed sterilization.

HUNGERFORD (C. W.). **A Fusarium blight of Spinach.**—Abs. in *Phytopath.*, xii, 9, p. 447, 1922.

A rather serious disease has recently appeared on spinach in Idaho, attacking the plants when young, stunting their growth, causing curling of the leaves, and finally killing them. A species of *Fusarium*, which appears to be new, was constantly isolated from the interior of the crowns and roots of diseased plants, and plants grown in sterilized soil inoculated with this fungus developed the characteristic symptoms of the disease.

BARSS (H. P.). **Destructive rust (Puccinia subnitens Dietel) on Spinach in the northwest.**—Abs. in *Phytopath.*, xii, 9, p. 446, 1922.

In 1922 the vegetable growers of Oregon sustained heavy losses on their early and late crops of spinach owing to the serious damage caused by *Puccinia subnitens*.

Distichlis spicata, the teleutospore host of *P. subnitens*, was

found to be one of the three commonest grasses growing in the vicinity of the spinach beds, and experiments at Corvallis have demonstrated that rust sporidia from *D. spicata* can infect the cultivated spinach.

LEONIAN (L. H.). **Stem and fruit blight of Peppers caused by Phytophthora capsici sp. nov.**—*Phytopath.*, xii, 9, pp. 401–408, 2 figs., 1922.

A disease which attacks the pods and branches of chilli peppers (*Capsicum annuum*) in New Mexico was found to be caused by a species of *Phytophthora*. It usually appears at the beginning of the warm, rainy season in June or later. Small, water-soaked, dull green spots form on the fruits, and develop into elongated lesions that dry up and become straw-coloured. Lateral spread is limited, but the fruit is penetrated and the seeds attacked. The latter are sometimes killed, but remain viable when only the seed coats are infected.

From the fruits extension to the branches takes place, the young shoots being rapidly blighted and destroyed. Usually progress is arrested at the older branches or the main stem. Secondary infections caused by liberated zoospores may occur, especially at the forks, causing girdling lesions which kill the parts above. Lateral spread is much more marked on the branches than on the fruit. The roots are not attacked, except for local lesions on the fine, lateral roots.

The fungus was isolated and grown in pure culture, from which successful inoculations were invariably obtained. It is regarded as a new species, to which the name *P. capsici* is given. It falls in Rosenbaum's *Phaseoli* section, characterized by basal ('amphigynous') antheridia. From the other members of this group it is distinguished by its gnarled, tuberculate mycelium; the large, though very variable, sporangia (35 to 85 by 21 to 56 μ or occasionally up to 105 μ long); the abundant, slightly wrinkled, brown oospores, 25 to 35 μ in diameter; and the absence of chlamydospores.

Infected seeds are an important agent in dissemination. Diseased pods are often not discarded owing to the slight external symptoms. When their seeds are planted the fungus grows out and fructifies in the soil. Infection takes place by zoospores produced in the soil and spattered by rain on to the lower fruits that hang down near the ground.

It is believed that careful seed selection and spraying should be effective in controlling the disease, though no experiments in control have been tried as yet.

CRÉPIN (C.). **Un Oïdium de la Betterave.** [An *Oïdium* of the Beet.]—*Bull. Soc. Path. Vég. de France*, ix, 2, pp. 118–119, 1 fig., 1922.

An *Oïdium* was observed at Grignon in the autumn of 1921 on beetroot [*Beta vulgaris*] (both fodder and sugar beet) and on *Beta maritima*. The mycelium is very delicate, and covers the whole of the leaf surface on both sides. The conidia are unusually long, mostly 30 to 40 μ; those below 27 are rare, while many are over

40, and a few reach 50 μ. Their width varies within narrower limits, between 9 and 12 or 13 μ, the average being 10 or 11 μ. The conidiophores are usually very long, and terminate in a single conidium. Mycelium, conidiophores, and conidia, as is common in the Erysiphaceae, are covered with small, hollow protuberances. The appressoria are lobed. The conidia of this fungus agree in length with those described in *Microsphaera betae* Vanha (44 by 15 to 20 μ), but they are very much narrower.

POOLE (R. F.). **The Sclerotinia rot of Celery.**—*New Jersey Agric. Exper. Stat. Bull.* 359, 27 pp., 15 figs., 1922.

A disease caused by *Sclerotinia libertiana*, affecting all the varieties of celery grown in the greenhouses in the muck bog areas of Bergen County, N.J., has been very destructive for a number of years. It particularly affects seedling plants, which are grown under glass from seed sown in February to be set out in the fields in April; in such cases losses up to 95 per cent. of the crop may be caused. Severe damage in the field has not been observed. The affected seedlings are attacked at the collar and fall over, a white cottony growth of mycelium developing on the leaves and stem after they fall. Sclerotia may appear very quickly and undoubtedly carry the fungus over in the soil. They may bear apothecia in the houses from March to June. Sometimes a watery soft rot, similar to that in the field outbreaks, is caused by the attack of this fungus on celery in storage.

Lettuce drop is caused by the same fungus, and cases have been observed where infected soil from lettuce fields has served to cause infection in celery houses. It appears to be a common practice to grow lettuce in rotation with celery, and this intensifies the disease.

The control measures recommended are the use of clean soil, or treating the infected soil with a formaldehyde solution (3 pints of formalin to 50 gallons of water, applied at the rate of 1 gallon to the square foot, 7 to 14 days before sowing), or steam sterilization of the beds, which, however, is not always practicable for small growers. The question of ventilation should also receive attention. Greenhouses constructed so as to be exposed to the sun's rays in all their parts, and fitted with proper ventilating devices, have consistently shown the smallest percentage of infection. Removal of diseased plants is effective if done early.

The author states that *S. minor* has so far not been observed in the bog soils of New Jersey, but it has attacked upland lettuce.

RIVIER (A.). **Observations sur le Sclerotinia libertiana Fckl.** [Notes on *Sclerotinia libertiana* Fckl.]—*Bull. Soc. Path. Vég. de France*, ix, 2, pp. 134–137, 1922.

'Lettuce drop', caused by *Sclerotinia libertiana* Fckl., is responsible for heavy losses in the south-eastern portion of France, half the crop being frequently destroyed by it in the Hyères (Var) district. The virulence of the disease seems to reach its height in November, just before the crop is gathered. At the Agricultural College of Montpellier, during the spring, the fungus frequently attacks melon plants grown under glass on manure beds. Infection

occurs chiefly on the stems, especially at the point of bifurcation, which becomes characteristically livid and leaden in hue, the discoloration spreading somewhat rapidly. In a short while, under favourable conditions of humidity, the affected portion is covered by a dense, white mycelium, and the stem frequently breaks at this point. Proper ventilation and drying of the frame or house, as soon as the attack is noticed, usually prevents further spread. The same fungus was found on *Pyrethrum cinerariaefolium*, growing in an experimental field attached to the Pathological Station at Montpellier. Cross-inoculations on lettuce, melon, and *Pyrethrum*, and a comparison of the apothecia resulting from sclerotia collected from all three plants, established the identity of the three diseases. *Pyrethrum* is believed to be a new host for *S. libertiana*. The mode of attack on this plant follows the usual lines, that is to say the spread occurs by means of the mycelium, which is capable of running over the surface of the ground from plant to plant provided the soil is damp enough. The fungus enters the host at the soil level, the stem is covered with the white mycelium, and the plant dries up. On the surface of the stem in the vicinity of the collar sclerotia are formed, which vary in size from a grain of buck-wheat to one of oats. The disease in *Pyrethrum* does not appear to be of great importance, and is believed to be associated with the heavy, wet soil in which the plants were growing, and the vicinity of lettuce, melon, and other plants susceptible to attack.

Cocoe rot.—*Journ. Jamaica Agric. Soc.*, xxvi, 2–3, pp. 62–64, 1922.

Referring to the prevalence of cocoe [*Xanthosoma sagittifolium*] rot, the writer quotes a report by Ashby in 1912 to the effect that the disease was caused by a hitherto undescribed fungus, to which he gave the name *Hormiscium colocasiae* [given by Ashby as *H. xanthosomae* n. sp., and then changed to *Vasculomyces xanthosomae* n. g., n. sp. in *Bull. Dept. Agric. Jamaica*, N.S. ii, p. 151, 1913]. The fungus gains admission to the water-conducting system either from previous infection of the 'seed' used for planting, by means of infection of the freshly cut surface of the planted tuber, or through any subsequent wound of the root or tuber. The fungus obstructs the water-conducting channels, the bundles turn brown, and the internal tissues shrink and split. When the split extends to the surface, insects, worms, and other fungi enter and increase the rot. The first method of infection named above is very common; the fungus in the vessels extends far beyond the discoloured portions, and may still be present, though causing no obvious signs, in the material used for planting.

The 'Commander' variety appears to be specially liable to the disease, which presents certain analogies with the Panama disease of bananas. Continuous planting on infected soil naturally increases the trouble, and rotation of crops should be carefully practised. Maize and peas make good alternative crops to cocoes. The old cocoe roots should be grubbed out and burnt, the land limed, and trenches put through it. The disease is very severe on water-logged soil. The burning of diseased stumps and other refuse has the additional advantage of providing a supply of wood-ash for the soil.

VIVET (E.). **Le mildiou de la Vigne. Dates des invasions. Les périodes critiques des invasions de mildiou.** [Mildew of the Vine. Dates of invasion. The critical periods of mildew invasion.]—*Revue Agric. Afrique du Nord,* xx, 139, pp. 200–202, 1922.

From 1908 to 1913 the date of the first appearance of mildew [*Plasmopara viticola*] spots on vine leaves at the Maison-Carrée Agricultural Institute in Algeria oscillated between the 2nd and 19th of May. As the period of incubation is seven days, it might be concluded that it would suffice to apply the first preventive treatment during the last week in April. But events in 1921, when mildew spots appeared on the 16th April, upset this calculation, and on searching back through the records the author found that the earliest date of its appearance in the Mitidja district noted since 1888 was the 13th April. It follows that by thorough spraying in the last days of March or at the beginning of April the young shoots can be efficiently protected against attacks derived from the germination of the resting spores.

A comparison of the dates shows that the successive attacks of *Plasmopara* during the two very bad years of mildew, 1908 and 1921, synchronize almost completely, if one ignores the unusually early first invasion in 1921. This confirms the observations made in vineyards round Algiers, that the disease is particularly to be feared during May, notably round about the 15th of that month, coincident with the flowering period. This period the author designates as the first critical period for mildew. Though occurring more rarely, the invasions of 'brown rot' (mildew on the fruit) generally take place during the last half of June, towards the 20th of that month, which may be called the second critical period. This coincides with the rapid development of the fruit. Hence it is necessary to concentrate preventive treatment on the two critical periods, in May and in June. During rainy weather, or when mists occur in these periods, adhesive mixtures must be employed at least once a week, and in addition the bunches should be dusted with a fungicidal powder.

WALKER (J. C.). **Seed treatment and rainfall in relation to the control of Cabbage black-leg.**—*United States Dept. of Agric. Bull.* 1029, 26 pp., 1 fig., 2 pl., 1922.

None of the four methods of cabbage-seed disinfection tested, viz. with hot water, dry heat, formaldehyde, and corrosive sublimate, can be relied upon for the complete eradication of the blackleg fungus, *Phoma lingam*, without severe injury to the seed. Seed treatment, however, reduces the number of primary centres of infection by destroying a considerable proportion of the organisms present on the seed. It is doubtful whether dry heat can be used on a commercial basis, because of the wide range of susceptibility to injury in different lots of seeds and because of the difficulty of application. Hot water treatment was proved not to be superior to the chemical fungicides, and in view of the awkwardness of its application it is not at present considered suitable for general use. With the chemical fungicides treatment stronger than a 1 in 240 solution of formaldehyde or a 1 in 1,000 solution of corrosive

sublimate for thirty minutes, followed by rinsing, is often unsafe, though some lots of seed will stand much more, especially with corrosive sublimate. Of these two treatments, the latter seems to be slightly superior in controlling the fungus.

Experiments were also made in 1919 and 1920 to study the effect of rainfall on the development of the disease in the seed-bed. In 1919 untreated seed known to contain about 2 per cent. infection, was sown on 14th May in a bed divided into four plots, of which the first was left exposed to natural weather conditions, the second, exposed as the first, was sprinkled with water several times a week during dry weather, the third was covered with a cold frame during rains, and the fourth was covered every evening and during rainy weather. The protected plots were watered artificially, care being taken to avoid splashing and the consequent distribution of pycnospores. A few infection centres appeared in all plots about the 9th June after a period of heavy rain from the 1st to the 5th June. The subsequent spread of the infection was greatest in the first two plots, while in the two protected ones very little spread took place. The results showed clearly that when the splashing action of rain was eliminated spread was slight, while it was enhanced when the plants were artificially sprinkled. Although plot 3 was exposed to numerous heavy dews, these were apparently insufficient for the dissemination of spores to any appreciable distance. The experiments of 1920 confirmed these results. The author considers therefore that in regions where cabbage plants are grown in open seed-beds, variation in the rainfall during the period between the appearance of primary pycnidia and transplanting has a very great influence upon the development of blackleg. Where the plants are grown in covered cold frames or in greenhouses the disease can be checked by avoiding the splashing of water.

TAYLOR (W. A.). **Report of the Bureau of Plant Industry.** 34 pp., 1922.

This report covers the year ending 30th June, 1922. The Bureau of Plant Industry of the United States Department of Agriculture, at Washington, deals with all problems of plant production and, in addition to the head-quarters organization, maintains field stations and conducts experiments in all parts of the United States. Much of its work is carried on in co-operation with the officials of the different States. The scientific work is organized in thirty-two sections, eight of which are wholly occupied with plant pathology (exclusive of insect troubles which are the concern of the Bureau of Entomology), while in several of the others, as for instance the sections for cereal, tobacco, and sugar-plant investigations, the study of diseases of special crops is an important part of the work. On 1st September, 1922, the numerical strength of the Bureau staff was 1,990, of whom 672 were employed at Washington and 1,318 outside.

Amongst the most important results of the year's work, of interest to us, mention may be made of the following. With wheat the introduction into cultivation of rust-resisting varieties is steadily proceeding. Kota, a bearded, hard, red, spring wheat, discovered in 1918, has been tested at thirty experiment stations and found to

be nearly equal to the most resistant durum varieties in withstanding stem rust [*Puccinia graminis*]. The campaign for the eradication of barberry in the stem rust areas is now in its fifth year. Thirteen of the north-central wheat-growing States have enacted legislation requiring the removal of common barberry bushes. Altogether 5,625,289 bushes have been located and 4,457,638 removed during the entire campaign. True take-all (*Ophiobolus graminis* [*cariceti*]) has been found on wheat in six States and it has been shown that the 'rosette' disease, the cause of which is still unknown, is distinct both from take-all and the *Helminthosporium* disease. The latter affects chiefly durum wheat and no effective control measures are known.

The complex group of diseases causing root, stalk, and ear rots of maize are of great importance in many States, losses of over 30 per cent. having been experienced in certain trials during the year. The wheat scab fungus, *Gibberella saubinetii*, is one of the important parasites concerned, as is also the dry rot fungus *Diplodia zeae*, while *Fusarium moniliforme* is commonly associated. One or more species of *Cephalosporium* cause another type of disease, characterized by a purple discoloration of the stalks and leaves, browning of the fibrovascular bundles, and barrenness. Bacteria are also associated with these fungi.

Sugar-cane mosaic disease has been found to occur in all the cane-growing States, and a complete survey of its incidence has been made. The destruction of diseased plants and the use of healthy seed are the only known methods of eliminating it, and parts of Porto Rico and Florida have now been practically cleared of the disease in this way. The immune variety Kavangire [Uba] promises to displace the susceptible varieties in badly diseased areas.

The citrus canker [*Pseudomonas citri*] was thought to have been completely eradicated from areas of commercial citrus fruit production, but a centre of infection on grapefruit was discovered in Florida in May 1922, and about 750 trees were found to be involved. This outbreak is being dealt with. A few other infected spots were found in Alabama and Mississippi, there are scattered diseased trees in Louisiana but not in the commercial producing area, and parts of Texas still require attention. Further experiments with the Bordeaux mixture and oil emulsion spray confirm the previous conclusion that it will effectively and economically control melanose and stem-end rot of citrus fruits [*Phomopsis citri*] if applied to the young fruit.

The group of so-called degeneration diseases of potatoes—mosaic, leaf roll, and related troubles—has become the greatest handicap to potato improvement in the United States and causes heavy loss throughout the country. Investigations during the year under review indicate that both streak and curly dwarf are closely related to this group and can be transmitted by juice inoculations. Roguing the crop, in localities where the percentage of mosaic and aphid infestation is low, has reduced mosaic from 10 per cent. to 1 or 2 per cent. in one season. Varieties differ considerably in their reaction to the disease, but resistance is less common than previously believed.

Cucumber mosaic can be caused by infection from the common

milkweed [*Asclepias*], which is probably an important source of the disease as it is frequently found near the cucumber fields.

Amongst forest trees it is stated that 'blueing' or blue stain, caused mainly by species of *Ceratostomella*, is the most important degrading factor in air-seasoned southern yellow pine [*Pinus palustris*] and causes deterioration of many other timbers. In the south the control of this and of mould fungi is perhaps the biggest problem in the industry. The ring-scale fungus, *Trametes pini*, has been found to cause all but a small part of the loss through decay in the Douglas fir forests of Oregon and Washington, which contain nearly one-fourth of the remaining stand of saw timber in the United States. Losses of 20 per cent. are said to be common. Affected living trees can now be recognized by external indications, a circumstance that will be very helpful in the management of the forests.

Chestnut blight [*Endothia parasitica*] continues to spread southward. Certain surviving American trees in the infected area are being propagated from as being evidently resistant. Search is being made for resistant or immune varieties of chestnuts both in the United States and in other countries, in addition to attempts to secure these qualities by breeding.

Since attempts to exterminate the white pine blister rust [*Cronartium ribicola*] in the eastern States were abandoned in 1917, on the discovery that the disease had obtained too firm a footing, efforts have been concentrated on the development of practical methods of control, which would ensure the continued growth of white pines in spite of the presence of the fungus. These consist mainly in the eradication of cultivated and wild forms of currant and gooseberry bushes [the chief alternate hosts of the fungus] within 900 feet of the pines. It is stated that control measures can be applied by pine owners at economically practicable rates and that any stand of white pine, large or small, can be adequately protected. But it is considered that these measures will fail in their object unless they are applied generally within the next few years. The chief event of the year in regard to this disease was its discovery in British Columbia and the Puget Sound region of Washington State [see this *Review*, ii, p. 4]. Prompt action has been taken to determine the extent of the invasion and, if possible, to eradicate or control it. The Canadian blister rust quarantine to prevent western migration of this disease was enforced in 1916, but the age of the infections found in British Columbia in 1921 showed that it had succeeded in reaching that area prior to the quarantine.

Verslag over het jaar 1921. Departement van den Landbouw in Suriname. [Report of the Dept. of Agric., Surinam, for the year 1921.] 92 pp., 1922.

The report contains a few references to subjects of phytopathological interest.

Bud rot of coco-nuts caused so much damage in a plantation of 2·3 hect. in extent that further cultivation had to be abandoned. Oil palms (*Elaeis guineënses*) also continued to die of bud rot, only one palm being left alive out of the 130 African specimens that were planted in 1916. *Hibiscus cannabinus*, grown in small

quantities for experimental purposes, was severely attacked by a root disease. *H. sabdariffa* will probably, it is thought, prove much more satisfactory than the former species as a substitute for Bengal jute.

LEE (H. A.). **Observations on previously unreported or noteworthy plant diseases in the Philippines.**—*Philipp. Agric. Rev.*, xiv, 4, pp. 422–434, 8 pl., 1922.

Notes are given on the following diseases of plants in the Philippine Islands:

CITRUS. Psorosis or California scaly bark, a disease of unknown origin, causes heavy losses on the sweet orange (*C. sinensis*) and has apparently been present for many years. Florida scaly bark or nail head rust also occurs in Batangas on this host but does little damage. Foot rot, reported to be due to *Phytophthora terrestria* [*P. parasitica*], severely attacks seedling trees of sweet orange and trees budded on sweet orange stock, being probably, next to psorosis, the most serious disease of citrus in Oriental countries. Bark rot, due to an unknown cause, is responsible for heavy losses to mandarin oranges (*C. nobilis*) in the Philippines. Experiments indicate that the disease may be controlled by spraying. Pink disease (*Corticium salmonicolor*) is serious in highly cultivated groves but is readily controllable. Citrus canker (*Pseudomonas citri*) is widely distributed, but most of the varieties grown are resistant. Withertip of limes (*Gloeosporium limetticolum*), withertip of grapefruit and sweet oranges (*Colletotrichum gloeosporioides*), mottled leaf, greasy spot, and sooty mould (*Meliola* sp.) all occur but are of no great importance.

BANANA (*Musa sapientum*). Wilt (*Fusarium cubense*) was detected for the first time in the Philippines in June 1920 and is probably widely distributed throughout the islands. The occurrence of the disease is sporadic; one plantation may be severely affected while adjacent groves remain immune. Heart rot, causing a decay of the terminal bud accompanied by a black discoloration and unpleasant saline odour, is common but does not cause extensive injury. The author believes that it has not yet been reported from other countries. Freckle (*Phoma musae*), a disease occurring on many varieties of banana including the wild banana and abaca, and in isolated parts of the country, is probably endemic. It is of no great importance at present.

ABACA (*Musa textilis*). Heart rot, similar to that of banana, is due to a fungus not yet described, and causes a continuous slight reduction in the total annual production of Manila hemp. A root rot that usually follows the attacks of the root borer (*Cosmopolites* sp.) is mentioned, while another root rot, associated with a species of *Marasmius* and apparently not previously reported, occurs occasionally. Leaf spot diseases of slight importance also have been observed.

SISAL, ZAPUPE & MAGUEY (*Agave* spp.). Anthracnose (*Colletotrichum agaves*) was first observed in 1921 on sisal (*A. cantula*) and zapupe (*A. zapupe*), having probably been introduced on zapupe plants from Mexico. The disease is extremely serious on the latter,

the plants being rendered useless for fibre production. Sisal and magney are less severely affected.

PINEAPPLE. Pineapple wilt [cause not specified] is now recorded for the first time in the Philippines, where it occurs on Hawaiian varieties only. On one estate the losses were fairly severe, but the disease has not made much headway as yet, and should be easily eradicable. The rot due to *Thielaviopsis paradoxa* is very general and severe on the leaves, suckers, and fruits.

TOBACCO. Root rot (believed to be that due to *Thielavia basicola*) is the most serious disease of field tobacco in the Philippines, though it has not been previously reported. Bacterial wilt (*Bacterium solanacearum*), *Sclerotium rolfsii*, and the *Cercospora* [*nicotianae*] leaf spot are all present but do not cause serious losses. Mosaic disease affects a large proportion of mature plants but the damage it causes has apparently not yet been recognized by the growers.

COCO-NUT. Bud rot is reported from all the most important coco-nut producing districts of the Philippines. The Bureau of Agriculture is carrying on a campaign for its eradication. Leaf spot (*Pestalozzia palmarum*) is widespread but not serious, the palms usually outgrowing the disease after a few years. Stem bleeding disease, as described from Ceylon [*Thielaviopsis paradoxa*], occurs in Mindanao and Sulu. In the former district especially it curtails the life of the palms.

SUGAR-CANE. Besides smut (*Ustilago sacchari*), mosaic, and Fiji disease, the following also occur: pineapple disease (*Thielaviopsis paradoxa*), *Sclerotium rolfsii*, top rot, rust (*Puccinia kuehnii*), wilt (*Cephalosporium sacchari*), root disease (*Marasmius sacchari*), leaf spots caused by *Bakerophoma sacchari*, *Leptosphaeria sacchari*, *Phyllachora sacchari*, *Cercospora kopkii*, and *Pestalozzia fuscescens* var. *sacchari*, sooty mould (*Meliola arundinis*) banded sclerotial disease (*Sclerotium* sp.), and downy mildew (*Sclerospora sacchari*). A disease somewhat resembling sereh, but believed to be distinct, is termed red vascular disease. It is considered to be identical with a sereh-like disease of D 1135 cane in Hawaii. Red rot (*Colletotrichum falcatum*) has not yet been found on cane stems in the Philippines but *C. falcatum* attacks and kills the leaves in damp, warm weather. *Melanconium sacchari* has not been observed to cause any injury. The flowering parasite *Aeginetia indica* often causes disastrous losses in certain localities.

COOK (M. T.). **Report of the Department of Plant Pathology of the New Jersey Agricultural College Experiment Station for the year ending June 30, 1921.** pp. 423–475, 3 pl., 1922.

A list is given of the problems under investigation, and the most important diseases of the year are classified under the plants attacked. Dr. W. H. Martin contributes a report of potato-spraying tests, which indicated that five applications of Bordeaux mixture for the control of early blight [*Alternaria solani*] and tip burn gave good results, the 5–5–50 being better than the 4–4–50 formula. Details of his experiments in the control of potato scab [*Actinomyces scabies*] with sulphur are also given. Mr. R. F. Poole investigated root rots of celery and horse-radish and carried out experiments in

the control of field diseases of sweet potatoes. Most of this work has been already noticed. Eggplant wilt (*Verticillium albo-atrum*) was studied by Mr. C. M. Haenseler; the disease is serious in New Jersey and the results of inoculations showed that it may cause severe stunting and reduction in yield even when typical wilting is absent. He also continued his experiments in spraying for the control of pear fruit and leaf spot (*Fabraea maculata*). Satisfactory control was effected by four applications of lime-sulphur (1–40), Bordeaux mixture (3–4–50), 'pyrox', and self-boiled lime-sulphur (8–8–50), but only the last caused no spray injury.

Under the title 'Foliage injuries' Dr. Cook deals with the excessive leaf-fall of various deciduous trees, attributable mainly to the sudden alternations of warm weather and frost in the spring of 1921. In the case of the cherry, the leaf spot fungus *Cylindrosporium padi* was also involved. Leaf scald of urban shade trees was caused by the lack of water and food due to the system of drainage in towns, which is directed to preventing the percolation of water into the soil, combined with excessive transpiration. It can be controlled to some extent by pruning out 25 per cent. of the branches in the autumn, by the application of fertilizers in the spring, and by loosening the soil round the roots of the trees.

Departmental Activities: Botany.—*Journ. Dept. Agric. S. Africa*, iv, 5, p. 405, 1922.

A serious outbreak of anthracnose (*Colletotrichum trifolii*) of lucerne has recently occurred in the Uitenhage district. It generally affects the stems and petioles, on which elliptical, sunken spots develop, the leaves being rarely attacked. The plants are said to suffer the greatest injury when the seedlings are exposed to prolonged dry weather, and again during the ripening of the seeds when the effects are most severe on the stem just above the ground level. No definite control measures are known, the only reliable remedy being apparently the raising of resistant varieties.

One of the most serious troubles in the nursery, and the most destructive disease affecting apple stocks, is the *Sclerotium* disease of Northern Spy stocks, the control of which requires constant vigilance. The stocks frequently die out in patches, the collar being covered with white mycelial strands, and minute, hard, brownish sclerotia, not unlike lucerne seed, being found in the soil. The fungus can spread rapidly through the soil. Rotation would appear to be the most effective preventive measure, the site of the nursery being changed frequently. The roots of all stocks, on transplanting, should be sterilized by dipping in a formalin solution. Dead plants, and those adjacent to them, must be incinerated and the soil in which they were growing disinfected.

Nowell (W.). **Diseases of Cacao in Trinidad.**—*Proc. Agric. Soc. Trinidad and Tobago*, xxii, 5, pp. 483–493, 1922.

This is a semi-popular account of fungous diseases affecting cacao plants in the British West Indies, especially Trinidad. *Diplodia* [*theobromae*], which was long believed to be the cause of die-back, is regarded by the author as a weak parasite, the primary cause of this disease being faulty soil and other cultural conditions. The

cacao tree is, by its nature, suited to humid conditions; it requires a considerable depth of soil and a fairly abundant supply of humus, and these requirements are usually met by treating the plantations so as to approximate to forest conditions, as, for instance, by interplanting with shade trees, growing wind screens, close planting, and the addition of pen manure or a heavy vegetable mulch to the soil. When such requirements are neglected, die-back is likely to appear even in the absence of *Diplodia*, and die-back can usually be treated by purely cultural methods, directed to remedying soil, drainage, and other defects of the kind. A condition resembling die-back may also be present in trees suffering from *Rosellinia* root disease.

Another trouble in which *Diplodia* often plays a secondary rôle is black pod rot and canker due to *Phytophthora faberi*, a fungus found in all cacao-growing countries, and of great importance to the industry of Trinidad, where the loss from this cause has been estimated as varying from 30 to 60 per cent. of the ripe pods, while young pods are also heavily affected. As spraying is out of the question at present in Trinidad, owing to local conditions, the author recommends efficient soil drainage and reduction of shade trees to the minimum required, where they cannot be dispensed with altogether or replaced by marginal wind-breaks. The pruning of the cacao trees themselves to ensure adequate aeration is recommended, and also the removal and disposal of all diseased pods. In treating canker the author does not favour deep excision and recommends instead the removal of the outer layer of the bark to enable the patch to dry out. Dressings which prevent the drying should be avoided.

The algal disease [*Cephaleuros virescens*] produces effects somewhat resembling die-back, especially on young trees before they are fully established or when planted in poor soils or exposed positions. The affection disappears with the provision of adequate shelter and the improvement of the soil. A minor disease is thread blight which develops only under conditions of excessive humidity.

The root disease caused by *Rosellinia* [*R. bunodes* and *R. pepo* have been recorded] occurs in several districts in Trinidad. In new clearings it spreads to living trees from certain kinds of forest stumps. In older plantations it usually occurs where forest material is deposited by flooded streams. It is a slow working disease caused by a fungus that grows in damp, sheltered situations on wood or other vegetable matter in or on the soil. The remedial measures recommended are chessboard trenching carried below the level of the lateral roots, in order to check extension of the mycelium which can spread through shaded soil rich in organic matter and also along the roots of the trees; the prompt removal and incineration of affected trees with as many of their roots as possible; and the proper cleansing of the surface of the soil and aeration of the deeper layers before replanting.

MAUBLANC (A.). **La pourriture brune du Cacaoyer.** [Cacao brown rot.]—*L'Agronomie Coloniale*, vi, 54, pp. 177–183, 2 pl., 1922.

The author gives a summary of the present state of knowledge of cacao brown rot (*Phytophthora faberi*) which, he states, is one of the most serious diseases amongst tropical cultures. Navel has

reported a case in San Thomé in which 90 per cent. of a particularly fine crop was rendered worthless by brown rot. The author does not believe that the oospores of the fungus have been seen, the bodies taken for these being really chlamydospores. These germinate in a manner similar to that of the conidia. He states that the chances of infection could be reduced by the removal of mosses and lichens growing on the trees, and by pruning the latter so as to ensure a better access of air and sunlight. Diseased fruits should be picked and destroyed immediately they are noticed, and infected material should not be left lying on the ground. Good results have also been obtained by spraying the trees with copper fungicides (Bordeaux mixture with an addition of sugar and resin as adhesives). According to Navel this treatment now forms part of the routine in many plantations in San Thomé.

MELCHERS (L. E.) & PARKER (J. H.). **Rust resistance in winter Wheat varieties.**—*U.S. Dept. of Agric. Bull.* 1046, 29 pp., 11 pl. (3 col.), 2 figs., 1922.

From 1914 to 1917 field experiments to test the resistance to black stem rust (*Puccinia graminis tritici*) of about 100 varieties and strains of winter wheat were carried out in a nursery at Manhattan, Kansas. The varieties included the hard red winter wheats of the Crimean group, such as Turkey and Kharkov, and the soft red winter wheats grown in eastern Kansas and elsewhere. In 1916–17 greenhouse experiments were conducted with the same varieties. Special methods were devised for the inoculation of the test plants with uredospores from rust cultures, and these are described in some detail. By these means severe epidemics of rust were produced each season, and the percentage of infection probably represents the maximum intensity of attack under Kansas field conditions.

With the exception of Kanred, P 1066, and P 1068, all pedigree strains, the winter wheats proved to be very susceptible to rust. In 1915 these three resistant strains were heavily rusted (40 to 70 per cent.), presumably owing to the presence in the nursery of some biologic strain of the fungus which was capable of infecting them, but in 1916–17 the infection percentages were low (5 to 25 per cent. as against 95 to 98 per cent. on some of the other varieties). Some degree of resistance was also exhibited by Kansas No. 2390. Severe rust attack usually reduces the plumpness of the kernels, but the grain produced by the three resistant varieties was of good quality, in contrast to the shrunken kernels of the susceptible strains grown under the same conditions.

Several varieties of spring wheat gave evidence of resistance, including Beloturka (C.I. No. 1513), Iumillo (C.I. No. 1736), Kubanka (C.I. No. 2094), Monad (D-1), and Pentad (D-5), all of the durum or macaroni group (*Triticum durum*). A hybrid of Iumillo x Preston, resembling the durum parent, was also resistant. The only resistant variety of the common or bread-wheat group (*T. vulgare*) was Black Persian. Ghirka Spring was very susceptible. Some degree of resistance was shown by all the strains of emmer and einkorn.

In the greenhouse tests the plants were investigated at two stages

of growth, in the seedling stage and at heading time. The results agreed on the whole with those of the field trials, except that Kansas No. 2390 gave no sign of resistance at either stage. The einkorn strains were also more susceptible in the greenhouse than in the field. Greenhouse tests alone do not, in the authors' opinion, furnish a reliable basis for conclusions as to rust resistance, and the results of such trials should be combined with those of nursery experiments in estimating the practical value of any variety.

The reaction of the three resistant varieties, Kanred, P 1066, and P 1068, to inoculation by the rust parasite differs markedly from that of other varieties described as resistant. In the latter prominent flecks are nearly always apparent in eight to twelve days after inoculation, small uredosori being frequently produced. In the three varieties above named, however, only the most minute and inconspicuous flecks are occasionally observed, while uredosori are entirely absent. Reports from Alabama, California, Illinois, Iowa, Missouri, Nebraska, New York, Wisconsin, and New South Wales confirm the results of the Kansas field trials with regard to the resistance of these three strains, but in Minnesota and South Dakota they were somewhat severely attacked by rust. The existence of distinct biologic forms of stem rust greatly complicates the study of resistance and susceptibility, and renders it probable that the behaviour of the wheats in question will vary according to the season and locality. In Alabama, Arkansas, California, Missouri, North Carolina, North Dakota, Oregon, South Dakota, Tennessee, Texas, Virginia, Wisconsin, and New South Wales the three resistant varieties are also resistant to leaf rust (*Puccinia triticina*). In the light of present knowledge it appears very probable that this resistance to leaf rust will be maintained under a wide range of conditions.

Kanred wheat presents a most unusual number of desirable agronomic characters, foremost among which are its high yield, earliness, and resistance to cold. In Kansas it yields from three to five bushels more per acre than either of the two commonly grown varieties, Turkey and Kharkov. Kanred is also reputed to equal the latter in milling and baking qualities. Its introduction into Oklahoma, Texas, Nebraska, eastern Colorado, and other States where hard winter wheats are cultivated, is now taking place on a large scale. Kanred wheat is likely to prove of great value as a parental variety in crosses on account of its resistant qualities, which are evidently transmitted to wheat hybrids in the same way as other characters. Several of the crosses already made appear very promising.

BRITON-JONES (H. R.). **The smuts of Millet.**—*Min. Agric. Egypt Bull.* 18 (Botanical section), 6 pp., 3 pl., 1922.

In this paper is given a short description of the three types of smut which attack sorghum (*Andropogon sorghum*) in Egypt, viz.: long smut (*Tolyposporium filiferum* Busse), head smut (*Ustilago reiliana* Kuehn), and grain smut [*Sphacelotheca sorghi* (Lk) Clinton]. Of these the first is the most common, and can be found in almost every crop of millet throughout the country, but the damage done by it is inconsiderable owing to the low percentage of heads

(rarely up to 2 per cent.) and individual grains (about 15 per head) attacked. The fungus, when young, is eaten by the fellaheen in some provinces, and is said to have a peculiar sweet taste; whether it has any effect on the health of the consumer, if taken in large quantities, is not known. Head smut is of rare occurrence in Egypt, and the loss caused by it is negligible, as is also that due to grain smut, although the latter is somewhat more frequent.

The life-history of *Tolyposporium filiferum* is not known, and the only recommendations that can be given for its prevention are to obtain seed from a healthy crop, to remove and burn the spore-sacs when young, and for a few years not to grow sorghum on land that has had a smutted crop. Disinfection of the seed had no effect on this smut in the author's tests, but prevented grain smut. Special treatment against head smut is said to be unnecessary at present.

HECKE (L.). **Ueber Mutterkornkultur.** [The cultivation of Ergot.]—*Nachrichten deutsch. Landwirtschaftsgesellsch. Oesterreich*, cii, (N.F. 6), pp. 119–122, 1922. [Abs. in *Zentralbl. für Agrikulturchemie*, li, 9, pp. 240–242, 1922.]

The toxic properties of ergot—due to ergotin, histamin, cornutin, sphacelic acid, &c.—are stated to fluctuate according to origin, year, and method of preservation of the sclerotia. The latter are best preserved in lime. The writer describes experiments in the cultivation of ergot for medicinal purposes on its natural hosts.

Marchfeld rye was grown in pots and over some of the flowering ears test-tubes containing ripe ascigerous fructifications, resting on damp soil, were placed. The escaping ascospores infected the opening flowers, and a week after the removal of the tubes honeydew was formed in large quantities. The honeydew containing conidia was removed by means of small, dry strips of paper and collected in flat dishes. The drops should be allowed to dry on blotting-paper, as they will otherwise ferment. Conidia can also be obtained by growing the *Sphacelia* stage in pure culture in the laboratory on suitable media. By means of a sprayer of the type used in vineyards, water containing a suspension of the *Sphacelia* spores is then sprayed on the ears of a suitable variety of rye during the flowering stage. The process should be repeated for six consecutive days on account of the varying time of maturity of the flowers.

Practical experiments only can determine the commercial value of artificial infection on the lines indicated. In one instance Schlanstedt rye produced 284 kg. of ergot per hect., an average of three sclerotia per ear. The price of medicinal ergot has risen enormously, and this may render its cultivation profitable.

DE MONICAULT (P.). **L'Ergot du Blé.** [Ergot of Wheat.]—*Journ. Agric. Prat.*, lxxxvi, 34, p. 169, 1922.

The occurrence of ergot [*Claviceps purpurea*] on wheat, usually regarded as quite exceptional, has been frequent among the French crops during 1922, especially in the province of Ain. The abrupt alternations of early heat, rain, and cold are thought to have induced an unusually open condition of the glumes, so that the enclosed florets were more accessible to the attacks of the fungus. The

disease was particularly severe on imported Swiss varieties. In view of the high degree of toxicity of the fungus it is very necessary to cleanse contaminated grain by immersing it in water and skimming off all the infected grains, which rise to the surface.

STÄGER (R.). **Beitrag zur Verbreitungsbiologie der Claviceps-Sklerotien.** [Contribution to the biology of dissemination of *Claviceps* sclerotia.]—*Centralbl. für Bakt.*, Ab. 2, lvi, 14–16, pp. 329–339, 2 figs., 1922.

It is generally assumed that the sclerotia of *Claviceps* on reaching maturity fall to the ground close to their host and lie there till the spring, when they germinate and give rise to stromata bearing perithecia and ascospores. The ascospores are then disseminated by means of the wind or of insects. In certain cases, such as that of ergot of rye, this is undoubtedly what occurs. A study of *Claviceps* sclerotia from wild grasses, however, shows that the fungus is not solely dependent on the wind or insect dissemination of its spores, but is also transported in the resting mycelium or sclerotium stage. There are two methods of securing this end. Either the sclerotium makes use of its host's contrivances for dissemination, or it is itself provided with such adaptations.

The author's observations and experiments deal with both alternatives. Two cases are described in which the sclerotium utilizes the host's contrivances for dissemination. *Brachypodium sylvaticum* has an oval caryopsis enclosed within the paleae. The inferior palea has at its apex a hook-shaped or sinuous awn, 1·5 cm. in length. This awn, with the caryopsis, easily attaches itself to passing persons or animals. The crescent-shaped sclerotium, which is surrounded by the paleae at the base, is taken up and transported in the same manner. In *Calamagrostis epigeios* (a new host) the sclerotia are 2 to 4 mm. long, $\frac{1}{3}$ to $\frac{1}{2}$ mm. thick, rod-shaped, and twisted. They are partially enclosed in and adhere to the lancet-shaped paleae. At the base of these paleae is a circle of fine hairs which often exceed the sclerotia in length. In dry weather this ring of hairs expands like an umbrella, and the paleae and sclerotium are carried away with great ease by the wind. It is probable that the autumn gales could carry them for a distance of several miles. A similar process probably occurs in *Melica ciliata* and *Phragmites communis*.

Only one adaptation of the sclerotium itself which aids dissemination is described. Experiments with *Claviceps wilsoni* Cke on the aquatic grass *Glyceria fluitans* showed that the sclerotia of this species float in water. Further tests, particulars of which are given, showed that the sclerotia occurring on the various grasses may be divided into floaters and non-floaters, and that this is correlated with their requirements. Thus the sclerotia of *Glyceria fluitans*, *Molinia coerulea*, *Phragmites communis*, and *Phalaris arundinacea*, all of which grow in or near water or bogs, can float and are not injured by long immersion, while those occurring on rye, *Lolium*, *Brachypodium sylvaticum*, *Sesleria coerulea*, *Arrhenatherum elatius*, *Agropyrum repens*, *Alopecurus myosuroides*, and other land grasses sink in water. The floating capacity of the

former group appears to be due solely to the air enclosed in the tissue of the sclerotium, as when this is removed they sink.

In 1899 the author showed that the ergot of *Phalaris arundinacea* was identical with that of rye, *Claviceps purpurea* Tul. The only modification undergone by the fungus on *Phalaris* is biological, the floating habit having been acquired to suit the new surroundings. This important alteration justifies in the author's opinion the creation of the new form *Claviceps purpurea* f. biologica *natans Phalaris arundinaceae*.

The sclerotia of certain land grasses (*Dactylis glomerata, Holcus mollis, H. lanatus, Poa annua*, and *P. nemoralis*) form an intermediate group between the floaters and non-floaters. Thus, in tests carried out near Berne, 69 per cent. of the sclerotia of *Dactylis glomerata*, 40·4 per cent. of the sclerotia of *Poa nemoralis*, 60 per cent. of the *Holcus* sclerotia, and most of those on *Poa annua*, floated. Possibly the sclerotia on these grasses, like those of *Calamagrostis epigeios*, are primarily disseminated by the wind, but when they are freed from the paleae they can float to a greater or lesser degree. In *Phragmites communis* there is little doubt that both methods are made use of.

PETHYBRIDGE (G. H.), LAFFERTY (H. A.), & RHYNEHART (J. G.). **Investigations on Flax diseases. (Third Report.)**—Reprinted from *Journ. Dept. of Agric. and Techn. Inst. Ireland*, xxii, 2, 20 pp., 11 figs., 1922.

This report continues the investigations on flax diseases from previous years [see this *Review*, i, p. 173].

The dry weather of 1921 tended to suppress the growth and spread of parasitic fungi, especially during the drought of the early part of the summer. Investigations of seedling diseases were therefore necessarily limited in their scope. Thus only three reports were received of seedling blight (*Colletotrichum linicolum* Pethybr. & Laff.). In the absence of rain the conidia were not washed from the cotyledons to the stems, so that lesions on the latter were uncommon. The lateral spread of the disease from one plant to the next was also inhibited by the drought.

'Browning' and 'stem-break', both due to *Polyspora lini* Laff. [see this *Review*, i, p. 176], caused little damage, as they only appeared late in the season when most of the crops had been harvested. As infection starts at the base and proceeds upwards, an experiment was conducted to ascertain whether the flax flea-beetle (*Longitarsus parvulus*) could carry the conidia from a lower to a higher leaf. The result showed that the insects can carry the disease, presumably by mechanical transfer of the conidia, to the leaves near the apex from diseased cotyledons near the soil. Once established on the upper leaves the spread of the disease to adjoining plants is assured by direct contact or other means.

The disinfection of flax seed has hitherto been complicated by the fact that the wetted seeds adhere together owing to the outer wall of the epidermis of the seed coat becoming mucilaginous when moist. It was shown, however, by recent trials that this does not take place to any extent, nor is germination reduced, when the seed is steeped from one to five hours in one to ten per cent. aqueous

solutions of copper sulphate. On removal from the steep the seeds should be mixed with dry, freshly slaked lime, which, reacting with the copper sulphate, forms a 'Bordeaux' precipitate on each seed. The addition of a small quantity of 40 per cent. formaldehyde to the copper sulphate was also found to be harmless. As a result of these preliminary tests, a series of experiments on flax seed, naturally infected with *P. lini*, was carried out with varying proportions of copper sulphate and formaldehyde, separately and together. The germination of the seed was somewhat impaired by the use of formaldehyde alone, applied either by steeping for ten minutes in 0·1 or 0·2 per cent. formaldehyde or by spraying with 0·5 per cent. formaldehyde so as just to wet the seeds without causing them to become mucilaginous. No injury resulted when 0·2 per cent. formaldehyde was used in conjunction with copper sulphate (steeped for one hour), the latter apparently rendering the seed coat more or less impermeable. Neither seed treatment nor spraying the plants with a 2 per cent. Bordeaux mixture proved effectual in eliminating the disease and subsequent spread led to the treated plots becoming as severely infected at the end of the season as the controls.

Previous tests had shown that the resting or teleutospores of *Melampsora lini*, which cause the black 'fired' areas on flax stems, could, under certain conditions, remain viable from the autumn of one year to the spring of the next. During the summer of 1921 evidence was obtained that the teleutospores can retain their vitality for an even longer period, 'fired' material harvested in 1919 and subsequently stored indoors having successfully infected pots of healthy flax seedlings on which it was spread in the spring of 1921. It is improbable, however, that even under excessively dry conditions, the teleutospores could survive for seven years, the period allowed in Ireland to elapse between successive crops of flax in any given field. The various attempts of the authors and other workers to transmit the strain of this rust commonly found on *Linum catharticum* to cultivated flax have given negative results, and it is now regarded as certain that the two are distinct biologic species. Uredospores of *M. lini* from cultivated flax inoculated on *L. angustifolium* caused only slight infection.

Root rot (*Thielavia basicola*) occurred sporadically in one crop. The plants were pale green and stunted in appearance, owing to malnutrition resulting from a diseased condition of the roots, the whole root system being involved in some cases, while in others only the youngest portions were affected. Microscopic examination revealed the presence of the chlamydospores and conidia of the fungus and inoculation experiments proved its pathogenicity to flax. It was found that two common weeds, groundsel (*Senecio vulgaris*) and goosefoot (*Chenopodium album*), also acted as hosts of *T. basicola*, the latter being specially susceptible. The eradication of these and other susceptible weeds and the cultivation of two successive root crops previous to flax would probably leave the soil comparatively healthy.

'Flax Droop' is the name proposed for an apparently non-parasitic disease of the taller pure line varieties observed for the first time in 1921. The first symptoms were noticed on 10th July,

when the plants presented a prematurely ripe appearance. The upper portions were light green in colour and drooped considerably, though actual wilting was not observed. The upper parts of the stalks were soft and herbaceous, but the base and the excessively numerous lateral branches arising below the affected part were normal. About flowering time, and before the development of the seed-bolls, the tops of the affected plants turned yellow, bent over still more, and eventually died. An examination of the roots and stems for the presence of parasites gave negative results. In plants but recently affected the fibre elements of the vascular bundles on the upper or convex side of the drooping stem appeared partially dissolved, while those on the lower or concave side were still normal. At a later stage this condition became general around the vascular ring, and when the upper part of the stem was dead only a trace of cellulose thickening was visible in the fibres. The middle lamellae remained, though in a discoloured and disorganized condition. The immediate cause of 'droop', therefore, is a weakening of the fibres in the affected regions, but the origin of this degeneration is at present obscure. The excessive dryness of the soil in which the diseased plants were growing was not sufficient to account for it. Copious watering did not effect a cure, and dry conditions tend to promote the thickening, rather than the reverse, of the mechanical elements of plants. The value of the varieties in question, which depends largely on their length of stem, would be seriously diminished if this trouble were to become at all general. Seed has been saved in order to ascertain whether the disturbance is due to an inherited character of the varieties.

The fungus causing the *Sclerotium* disease of flax was definitely identified as *Sclerotinia libertiana*, a parasite which is perhaps best known in Ireland, under the name *Sclerotinia sclerotiorum* Massee, as the cause of the 'stalk disease' of potatoes. A healthy potato plant inoculated with a pure culture of the fungus from flax rapidly developed the typical symptoms of stalk disease. The latter has been observed at times in the North of Ireland, and its ability to spread to flax is of considerable interest.

SCHILLING (E.). **Beobachtungen über eine durch Gloeosporium lini verursachte Flachskrankheit in Deutschland.** [Observations on a disease of Flax in Germany caused by *Gloeosporium lini*.]—*Faserforschung*, ii, 2, pp. 87–113, 13 figs., 1922.

During 1920 and 1921 the flax disease which has been variously termed seedling blight, anthracnose, and canker by different investigators was observed near Sorau, this being its first recorded appearance in Germany. It is caused by the fungus *Gloeosporium* [*Colletotrichum*] *lini*, with which, in the author's opinion, Pethybridge's and Lafferty's subsequently described *Colletotrichum linicolum* is identical [see this *Review*, i, p. 173].

The symptoms of the disease are described at some length and stated to agree in the main with the accounts of Bolley, Pethybridge, and Miss Westerdijk. The last-named, however, reports a spotting of the leaves, stalks, and capsules of older plants which has so far not been observed in Germany, while the exposure of the woody portion of the base of the stem, due to the dissolution of the

tissues in advanced stages of the disease, as described by Pethybridge, was not specially noticeable in the German cases.

The fungus was isolated and grown in pure culture. Setae were not invariably present in the acervuli, their development apparently coinciding with dryness of the surrounding atmosphere. Judged by this criterion, the author thinks that the separation of the genera *Colletotrichum* and *Gloeosporium* cannot be maintained. Conclusive evidence was obtained that the disease is transmitted by the seed, by means of mycelium on the testa. Infection by spores direct from plant to plant or from the soil also occurs. In the author's experiments, all the varieties of flax and linseed tested were susceptible, but the conditions of the experiments were exceptionally favourable to infection, and under natural conditions in the field the disease was limited to Bombay and Sicilian linseed, Finnish fibre flax, Russian crown flax, and a Silesian fibre flax.

The disease causes a serious reduction of germination and sometimes a heavy loss of crop. It may best be prevented by the use of clean seed. The effects of climatic conditions, methods of cultivation, and the like have not yet been sufficiently studied to allow of any recommendations of practical value being made in regard to them. It has been observed that the plants succumb to the disease more readily in dry than in damp weather, but that the parasite is more readily disseminated during the latter. The control measures advocated by previous workers on this disease are discussed, and although the author does not appear to have tested them, he is of opinion that such measures could only be applied on a large scale with great difficulty and expense, and that the use of clean seed is the most essential requirement.

LACEY (MARGARET S.). **Studies in bacteriosis. VI, Bacillus carotovorus as the cause of soft rot in cultivated Violets.**—*Ann. of Appl. Biol.*, ix, 2, pp. 169–170, 1922.

This is an account of the occurrence in England, early in 1921, of a destructive disease of cultivated violets caused by *Bacillus carotovorus*. The plants examined had the whole interior of the stem reduced to a soft white mush, the rot spreading to the petioles and causing the leaves to fall. The organism was isolated and identified by comparison with authentic cultures of *B. carotovorus*. Inoculations reproduced the disease in violets and also caused the characteristic white rot of carrots, turnips, potatoes, and onions.

CADORET (A.). **L'Abricotier dans la Vallée du Rhône.** [The Apricot in the Rhone Valley.]—*Journ. Agric. Prat.*, lxxxvi, 39, p. 271, 1922.

For the last thirty years a gummosis of apricot trees, accompanied by the attacks of a hitherto unidentified parasite, has been known in the alluvial soil of the Rhone Valley [see this *Review*, i, pp. 180 and 385]. The writer had opportunities for studying it, while stationed at Tournon (Ardèche) from 1901 to 1913. The damage is particularly severe between Lyons and Peyraud, and between Lyons and Saint-Rambert. The disease is practically non-existent on the dry soils of the hill-sides on the left bank of the river, and from the vicinity of Avignon as far as Tarascon.

The average duration of the disease is two to three years, though it may be fatal within a year in localities exposed to frequent floods. Older trees are uniformly more susceptible to the disease than young ones. During the first year of the attack the trees often present a curious appearance, some portions being healthy and others withered. The following year the withering is complete. It has been observed that the disease is most prevalent in orchards formerly used for the cultivation of mulberries. Cherry trees in excessively wet or dry soils exhibit somewhat similar symptoms. Isolated cases of the withering of apricots in schistose soils have been reported from St. Jean-de-Maurienne (Savoy), where the symptoms appear to be identical with those in the Rhone Valley.

The writer believes that the withering is due to a fungus or bacterium which invades the roots and wood of the stems, or the latter only, and is accompanied by gummosis. As practical measures to reduce loss he recommends that plum trees should not be used as stocks, unless they are planted level with the soil, the roots being covered with a mound, at least 1 m. in width by 0·50 m. in height. The same planting in mounds is advisable with all apricots grown in localities subject to inundation or where the disease is already present. Apricot orchards should be opened, when possible, only in new soil.

HARRISON (T. H.). **Note on the occurrence in New South Wales, Australia, of the perfect stage of a Sclerotinia causing brown rot of fruits.**—*Journ. & Proc. R. Soc. of New South Wales*, lv, pp. 215–219, 1 pl., 1922.

In September, 1921, following a season of heavy brown rot infestation of orchard trees in New South Wales, the author found two apothecia of a *Sclerotinia* arising from mummified apricots in an orchard near Sydney. Tissue cultures from one of these on potato dextrose agar gave rise to a typical *Monilia* growth, and inoculation of loquat [*Eriobotrya japonica*] and apple fruits with conidia from a pure culture caused typical brown rot lesions. Further studies are in progress, but there are already definite indications that the organism is *Sclerotinia fructigena* and a distinct biologic form from both the European and American forms. The ascigerous stage of this fungus has not been previously recorded in Australia.

NORDMANN. **Der Apfelmehltau und seine Bekämpfung.** [Apple mildew and its control.]—*Deutsche Obstbauzeit.*, lxviii, 21–22, pp. 202–203, 1922.

Apple mildew [*Podosphaera leucotricha*] is stated to be assuming such serious dimensions all over Germany, and more especially in the south, where the summer months are often very dry, that it can only be checked by an organized campaign. One of the chief preventive measures is the selection of resistant varieties for planting, e.g. Charlamowsky, Queen, Winter Golden Pearmain, Lane's Prince Albert, &c. The cultivation of the two extremely susceptible varieties, Landsberger Renette and Cox's Orange, should be discontinued. The American variety Baldwin is the only one known to be wholly immune against mildew in Germany. Drastic and regular

pruning is another very effective means of control, the destruction of affected shoots in the summer being particularly important. Of the various fungicides those containing sulphur are chiefly recommended, excellent results having been obtained with solbar and in some cases with colloidal sulphur [see this *Review*, i, pp, 228 and 390]. Dusts are, however, considered to be preferable to sprays, and the new preparation 'elosal' is stated to be extremely effective.

CUNNINGHAM (G. H.). **Apple and Pear black-spot: their appearance, cause and control.**—*New Zealand Journ. of Agric.*, xxv, 1, pp. 20–31, 11 figs., 1922.

The symptoms of black spot [scab] of apple (*Venturia inaequalis*) and pear (*V. pirina*) are described and figured. The former is prevalent and is the most serious apple disease throughout New Zealand except in localities where the humidity is low during the growing season, such as Central Otago and certain districts in Marlborough and North Auckland. In New Zealand the ascigerous stage of the fungus develops in the 'spring' (August and September) from mycelium which has 'overwintered' in dead leaves. This stage is found only in the tissues of dead leaves, not on fruits or shoots.

Pear black spot differs from the foregoing in forming conidia freely on young shoots and laterals, sometimes continuously for as long a period as nine months, and it is almost certain that shoot infection is one of the means of carrying the organism over the winter. Perithecia are also produced abundantly on the fallen leaves, and the ascospores so formed are capable of infecting the new leaves and fruits in the spring.

In an appended note on the control of black spot, written by J. A. Campbell, it is pointed out that control by the destruction of infected leaves alone is impracticable, not only on account of the difficulty of ploughing in all the leaves, but also because of the danger from infected shoots. It is, however, advisable to plough deeply in the autumn, in order to bury as many leaves as possible and thereby minimize infection by reducing the number of ascospores. A series of spray applications is necessary to cover the danger period of ascospore infection and to destroy the conidia on shoots and prevent their subsequent development on leaves and fruits. The following schedule has been found to control the disease effectively in Auckland, Hastings, and Nelson, and is accordingly recommended to fruit growers. (1) Green-tip stage [pre-pinking or spur-bursting stage], 5–4–50 Bordeaux or 1–10 lime-sulphur, (2) between open-cluster and pink stage, 3–4–50 Bordeaux or 1–30 lime-sulphur; (3) calyx-spray (petal-fall), 1–100 to 1–120 lime-sulphur; (4) ten days later, 1–100 to 1–120 lime-sulphur; (5) every month until maturity, 1–100 to 1–120 lime-sulphur; (6) immediately before picking, 1–100 lime sulphur. The object of the last spray is to prevent storage infection, and it may be applied with advantage when the fruit is destined for export. Arsenate of lead may be added to the third and subsequent sprays for the simultaneous control of the codling moth and leaf-roll caterpillar. The period covered by the applications, and the thoroughness with which

they are given are stated to be more important factors in the control of the disease than the exact strength of the sprays.

CURTIS (K. M.). **Ascospore ejection of the Apple and Pear black-spot fungi.**—*New Zealand Journ. of Sci. and Tech.*, v, 2, pp. 83–90, 1922.

A series of experiments has been carried out to determine the duration of the period of discharge of ascospores from the perithecia of *Venturia inaequalis* and *V. pirina*, the fungi responsible for the black spot [scab] of apple and pear respectively. Five apple and three pear leaves were examined daily from 14th September to 20th December, 1921. It was found that ascospore ejection began on 14th September, reached its maximum on and immediately after 2nd October, ceased to be of practical significance by 31st October, and stopped entirely by 12th December. The season's discharge from both pear and apple leaves fell into several distinct periods. There was one period of maximum discharge, which occurred early in the season, five subsidiary periods of lesser importance, but still of practical significance, and several of negligible dimensions. The maximum output of spores for any one wet period occurred between 2nd and 11th October, in the case of all the leaves, both pear and apple. In the majority of the leaves the maximum average daily output for any wet period and the maximum single day's output for the season also occurred during this period. The output of spores from pear leaves, as compared with those of apple, is marked by a greater total number of spores ejected during the season, and a more uniform daily ejection which lasted over more protracted periods.

In another experiment four apple leaves were kept without water from 14th September to 6th December, during which time the majority of the perithecia passed through a very sensitive phase, that of the delimitation of the ascospores within the asci. This did not, however, prevent an appreciable ejection of ascospores when the drought was broken, although in normal leaves ejections of any magnitude had ceased for a month or six weeks before that time.

The usual system of cultivation followed in the orchards tends to bring to the surface a certain proportion of the leaves which have been ploughed in. If this occurs within six to eight weeks after the maturation of the perithecia, the latter will become a direct source of danger as soon as the rain begins. The leaves should therefore be destroyed by fire after they have fallen from the trees.

JARVIS (H.). **Fruit fly investigations.**—*Queensland Agric. Journ.*, xviii, 4, pp. 269–271, 1922.

In this report is included a section on plant pathology, containing notes by H. Tryon on certain diseases of deciduous fruit trees in the Granite Belt district of Queensland. The apple bark canker or bark blister caused by *Coniothecium chromatosporum* is stated to be prevalent all through the district and to attack also the pear. It causes the formation of dark areas in the outer bark, the cells being replaced by masses of closely packed, short-celled mycelium. The

segments of the mycelium ultimately become transformed into spores. A second stage with pycnidia of the *Phoma* type is also stated to occur. The attack results in a die-back disease of the twigs and may even kill fairly large branches. Seriously diseased branches should be cut out and the rest of the tree treated with Bordeaux mixture or lime-sulphur.

A second bark canker of the apple in this district is caused by the fungus *Gloeosporium malicorticis* which is also responsible for the bitter rot on the fruit. A short account of the disease is given and the same treatment is recommended as in the other case, with the addition that all rotting fruit should be removed and destroyed.

WATERS (R.). **Cool storage of Apples. An investigation of flesh-collapse.**—*New Zealand Journ. of Agric.*, xxv, 1, pp. 34–39, 1922.

Fruit kept in cool storage is liable to deterioration from a number of causes, which must be carefully distinguished in order to improve the methods of preservation.

Black spot [scab] of apples (*Venturia inaequalis*) undoubtedly continues to develop to some extent in cool storage, and judging by the very early stages of infection that are found, it is clear that it can also spread to sound fruit in spite of the very low temperature. In this case the remedy must obviously be applied before picking.

The disease known as 'sting' refers, strictly speaking, only to the injury succeeding insect punctures. Popularly, however, sting is a form of rot, caused directly by blue mould (*Penicillium*), bitter rot (*Glomerella*), or *Botrytis*, following some form of mechanical injury to the skin. Thus, the origin of this trouble is also to be sought before the arrival of the fruit at the store.

A third type of disease, known as scald, appears in the form of irregular, dark, sunken patches in the surface of the apple, and is caused by vapours or esters given off by the fruit. Scald is most severe among apples packed in barrels, and may be prevented by satisfactory ventilation or wrapping the fruit in oiled paper.

The cause of flesh-collapse, which is probably identical with the 'brown-heart' recently reported as occurring in shipments of Tasmanian and Australian apples to England [see next abstract] has not yet been definitely ascertained. The skin remains intact until the last stage of the disease, while part, or the whole of the interior may be in a state of collapse. Affected apples are springy to the touch. Fungous rots may set in and cause a discoloration of the skin. This disease has already been responsible for extensive losses, and the success of the apple export trade is largely dependent on its prevention.

Various causes have been suggested to account for flesh-collapse, such as drought followed by excessive rain, lack of cultivation, varying degrees of maturity of the fruit, age of the trees, and lapse of time between packing and delivery. Investigation has shown, however, that none of these reasons can be considered adequate, the disease occurring under the most varied conditions. The writer believes that individual apples, even of the same variety, differ

considerably on reaching the store in their degree of resistance to flesh-collapse.

In order to test the effects of varying temperatures, a number of Sturmer apples of different lines were subjected to alternating temperatures ranging between 20° and 60° F. No sign of flesh-collapse developed in any of the fruit. Various other attempts at the artificial production of the disease by fluctuating temperatures and other means were unsuccessful. Both in 1920 and 1921 flesh-collapse appeared in September, after the fruit had been in storage for three or four months. The general standard of temperature adopted in the stores was 32°, but there were considerable differences in the time during which the machinery was kept running.

The writer's hypothesis, upon which he is basing his present investigations, is that the flesh of the apple both cools and warms up more slowly than the atmosphere of the store, thus averaging out the varying temperature of the chamber. Some stores keep the refrigerating machinery running continuously so that the store remains for the whole twenty-four hours at 32°, while in others it is only kept running for eight hours, the insulation being relied on for the remainder of the day, and in these the average temperature of the apples will be above 32°. Prolonged exposure to a temperature of 32°, which is known to produce a peculiar physical action on water, might exert some strain on the flesh and consequently cause injury. On board ship and in stores where the machinery runs for long periods, abundant flesh-collapse occurs.

Two important lines of inquiry present themselves as a result of these observations; first, the investigation of the optimum temperatures for the storage of New Zealand apples, and second, the means of increasing the resistance of the fruit to cool storage conditions.

Brown Heart.—*Fruit, Flower, and Vegetable Trades' Journ.*, xlii, 17, p. 455, 1922.

Correspondence between the Agent-General for Tasmania, the Managing Director of the Fruit and Produce Exchange of Great Britain, and Dr. Charles Brooks of the Bureau of Plant Industry, Washington, on the subject of brown heart of apples, is reproduced in full.

A conference of shippers, growers, and others interested in the Australian business was recently called to consider the best means of dealing with brown heart, a disease of apples somewhat similar to apple scald, which has been prevalent in shipments during the last few years. Dr. Brooks states that brown heart is largely due to the accumulation of carbon dioxide given off by the apples, being also favoured by high storage temperatures and over-ripeness at picking-time. Though similar to internal breakdown [see last abstract] brown heart is a distinct disease, while it is totally different from scald, which is primarily a skin disease and can be controlled by the use of oiled wrappers. The removal of foul air from the boat chambers would largely prevent brown heart, while pre-cooling is also very advisable. The latter process, however, can be dispensed with if adequate refrigeration and ventilation are ensured. The ships should carry self-registering thermometers, and a temperature of 30° to 34° F. should be maintained. Under present

shipping conditions it is dangerous to open up the storage chamber once it has been closed, the addition of fresh cargo causing a rise in the temperature of the fruit already cooled. During the period elapsing between the removal of the fruit from the ship and its arrival at the place of destination, it should also be kept at a low temperature.

SWINGLE (D. B.). **Pear and Apple blight in Montana.**—*Better Fruit*, xvi, 12, pp. 12–13, 18–19, 1922.

Fireblight [*Bacillus amylovorus*], which attacks apples, pears, and quinces severely, and stone fruit and pomaceous shrubs mildly, is extremely widespread in Montana. The disease, the characters of which are described in detail, is most virulent on rapidly growing, vigorous trees, the damage done to slow-growing trees being comparatively slight.

Amongst apple varieties, Duchess of Oldenburg, Gano, Ben Davis, Rome Beauty, Wagener, Stayman, Winesap, and Thomkins King are relatively resistant; McIntosh Red, Jonathan, Delaware Red, Grimes Golden, Wealthy, Baldwin, and Northwest Greening are moderately resistant; Yellow Transparent, Fameuse (Snow) Spitzenberg, Delicious, Whitney crab, Martha crab, and Hyslop crab are moderately susceptible; Alexander, Wolf River, Transcendent crab, McMahon, and Winter Banana, are very susceptible.

Of pear varieties, Kieffer, Flemish Beauty, and Beurré d'Anjou are moderately resistant; Bartlett moderately susceptible; and Clapp's Favourite extremely susceptible. It is recommended in grafting to use the Chinese sand pear (often called 'Japanese') as a stock, and Kieffer or some other resistant variety as a scion.

MILBRATH (D. G.). **Résumé of Pear blight history and methods of control.**—*Monthly Bull. Dept. Agric. California*, xi, 10, pp. 760–765, 1922.

Fireblight of pears (*Bacillus amylovorus*) was widespread and serious in California during 1922, especially in the Sacramento Valley and the adjoining foot-hills. Its occurrence in the coastal regions, and in the San Joaquin and Antelope Valleys, was sporadic. In other States also pear blight was very severe in 1922, the damage in New Jersey being probably heavier than ever before. The disease was reported to be prevalent in Michigan, Montana, Arizona, New York, Ohio, Missouri, South Dakota, and Washington. The direct losses from the disease in California may be estimated at 5 to 10 per cent. of the crop, in addition to the indirect loss due to heavy expenditure on control measures, and to a set-back in the growth of the trees as a result of drastic pruning.

An account is given of the symptoms of the disease, plants liable to infection, and methods of dissemination. It is stated that the practice of bee-keeping, recently taken up by orchardists in certain districts of Washington, has greatly increased the severity of the disease.

Pear blight can be largely controlled by the use of resistant root stocks, e.g. *Pyrus ussuriensis*. The possibilities of infection may be reduced to a minimum by high budding, successfully practised

in Grass Valley with the susceptible Bartlett variety on *ussuriensis* root stocks. Seckel, Sand, Abraham, and Le Conte are also extremely susceptible, Kieffer, Duchess, and Winter Nelis slightly less so, and Douglas, a Kansas variety, comparatively resistant. Thorough pruning and excision of infected parts is very important. The most virulent and active bacteria are found on the margins and advancing points of the cankers, and the bark should be removed for at least four inches beyond the slightest tinge of discoloration. Suckers at the foot of the tree readily become infected and should be cut off as they appear. A solution of mercuric cyanide and corrosive sublimate (1 oz. of each to 4 galls. of water) is useful for washing wounds and disinfecting implements.

PUTTERILL (V. A.). **Pear scab in the Western Province: experiments and facts relating to its control.**—*Dept. of Agric. S. Africa, Bull.* 2, 31 pp., 12 pls., 1922.

Spraying experiments on experimental orchards at Ida's Valley, Stellenbosch (1920–1921), and at Lourensford Estate, Somerset West (1921–1922), are described. The results indicate that pear scab or *Fusicladium pirinum* (*Venturia pirina*) can be satisfactorily controlled by five sprayings with 4-4-50 Bordeaux mixture, the last three of which are given in combination with arsenate of lead in order to control the codling moth. This does not include a dormant spraying with lime-sulphur which is applied for general hygienic purposes before growth is renewed after the winter.

The schedule recommended is (1) when the buds are breaking and leaves just showing; (2) when the blossom buds have opened, but the individual blossoms are still closed, i.e. about ten days later than (1); (3) when the last petals are falling, i.e. about ten days later than (2); (4) ten days to two weeks after (3); (5) five weeks later. The tests demonstrated the importance of applying the mixture at least twice between the time that the buds begin to open and when they are ready for the first spraying against codling moth. The amount of diseased fruit varied from 2 per cent. in sprayed trees to 59 per cent. in unsprayed trees, and was always considerably greater when certain of the sprayings were eliminated than when the full schedule was given. Of proprietary mixtures tried, 'Arboretas' did not control scab, but 'Capex' Bordeaux mixture made by the Cape Explosives Co., was very successful, being apparently better than the home made mixture in some cases. The disease, lithiasis, supposed to be of physiological origin and occurring abundantly in the localities of the tests, [see this *Review*, i, p. 11], appeared to be almost completely controlled by the sprayings.

In a note on the occurrence in South Africa of the perithecial stage of the pear scab fungus, appended to the Bulletin, the author records the discovery in great abundance of perithecia of *Venturia pirina* on the previous season's leaves of Beurré Bosc pears in September 1921. Newly infected leaves were first found on the trees in the orchard from which the perithecia were obtained on the 6th October.

STANFORD (H. R.).—**Control of Peach scab.**—*Monthly Bull. Dept. Agric. California*, xi, 10, pp. 765–774, 5 figs., 1922.

During the last few years peach scab, caused by *Cladosporium carpophilum*, has been on the increase in southern California. While it is improbable that the disease will develop in California to such a severe extent as in the eastern United States, owing to the more favourable climate of the former, the author considers that control measures must be adopted to prevent considerable losses. The present paper deals with the results of investigations during the summer of 1922 on the prevalence of scab, varietal resistance, effect on grade and price, and control measures.

Of the varieties of canning peaches examined, Lovell was the most severely infected and Sims the least; Elberta and Phillips Cling were fairly free, while Muir and Tuscan varied considerably in different orchards. Orange and Lemon Clings and Salway are grown only on a restricted area in California, but those examined were free from scab.

In the orchard the disease is easily recognized in the late summer by the oval, brown lesions on the twigs. Towards autumn olive coloured patches and spots, consisting of mycelium and spores, are found on the under side of the leaves. The damage to the leaf is slight, and is important chiefly as affording greater numbers of spores for twig infection. By midsummer the infected fruit shows light spots which gradually deepen to dark olive, and may either remain separate or coalesce. Usually they occur only on the side of the fruit exposed to moisture, causing a retardation of development on that side. On late varieties the spots form cork cells, the scaling off of which has given rise to the name of scab.

The writer inspected the process of grading Lovell peaches at a cannery, and ascertained that the amount of scab in the 'C' and 'D' grades was 8·5 and 6·4 per cent. respectively. On the basis of these percentages the average result from a ten-acre orchard would be 10·4 tons of fruit placed in a low grade on account of the fungus. The corresponding pecuniary loss may be roughly estimated at $312 on the ten acres.

The life-history of the fungus is described. It overwinters beneath the surface of the twig, and therefore cannot be reached by a dormant spray. The fungus and the twig resume growth simultaneously in the spring, the epidermis of the twig being ruptured and spores formed in more or less conspicuous tufts on the surface. The spores are carried by the wind or other agents to the fruit, which is protected, however, for the first three or four weeks after setting, by its dense pubescence. After infection takes place there is an incubation period of forty to sixty days before the olive coloured spots referred to above begin to show. While the fruits are being infected new twigs are also attacked, and thus the life cycle is completed.

Experiments showed that excellent control of the disease could be secured by spraying with self-boiled lime-sulphur 32–32–200. One spray was sufficient for early ripening varieties and two for the later sorts. The fruit must be kept protected against infection from about a month after blooming until six weeks or two months before ripening. In the experiments recorded, the early ripening

variety was sprayed on 16th May and the late on 23rd May and 23rd June, excellent control being obtained. The use of commercial lime-sulphur or Bordeaux mixture is not advisable on account of the injury to peach foliage caused by these fungicides.

RABBAS. **Die Rutenkrankheit der Himbeersträuche.** [The cane disease of Raspberry bushes.]—*Nachrichtenbl. deutsch. Pflanzenschutzdienst*, ii, 6, p. 42, 1922.

In 1921 over 70 per cent. of the raspberry crop of an extensive plantation in Anhalt was destroyed by the cane blight due to *Didymella applanata*, and the inspection of a number of other plantations showed that the disease is more widely distributed than was previously suspected. It is characterized by the appearance from the end of June onwards of bluish-brown spots on the fruit-bearing canes, followed by a longitudinal rupturing of the bark, which peels off in rings. Owing to the similarity between the natural colour of the ripening canes and the spots caused by the fungus, the latter are not easily detected at a later period of the season. Minute black dots, the perithecia of the fungus, are scattered all over the loosened bark, and the spores liberated from these the following spring disseminate the disease. Infected canes wither before the fruit ripens, sometimes even in the early spring when the disease is frequently mistaken for frost injury. Many growers also confuse it with the effects of protracted drought or with senescence.

Little is known of direct measures of control. Infected canes must be cut away and burnt, and spraying with 1 per cent. solbar, 1 per cent. formalin, 2 per cent. Bordeaux mixture, 2 per cent. milk of lime, or 0·05 per cent. colloidal sulphur is provisionally recommended. The first application should be given in the autumn, when the soil should also be treated with caustic lime (½ to 1 kg. per sq. m.), and the bushes lightly hilled to prevent the spread of spores adhering to the stumps. The second application of the fungicide should be given in the following spring, two or three weeks before the appearance of the leaves, repeating the process at intervals of two to three weeks if necessary. The use of fertilizers containing potash and phosphoric acid is recommended and also lime, especially where the soil is acid.

Conflicting opinions as to varietal susceptibility appear to be held. Marlborough is universally recognized as susceptible, while Superlative appears to be heavily infected in some plantations and immune in others. Comparatively resistant varieties are the Harz Jewel, Knevcth Giant, and Schaffer's Colossal.

WILCOX (R. B.). **Eastern blue-stem of the black Raspberry.**—*U.S. Dept. of Agric. Circ.* 227, 12 pp., 1 pl., 1922.

Eastern blue-stem or curly leaf, a disease which does not correspond with any previously described, is responsible for severe losses in a number of regions where black raspberries are intensely cultivated in Ohio, New York, Michigan, and Wisconsin.

The general effect produced by the disease is a gradual stunting and reduction of vigour. During the first season of infection the symptoms may be somewhat inconspicuous, the plants giving a good

crop of fruit. The berries, however, are smaller and more brittle than usual, and the shoots shorter and weaker. The hindrance to food storage causes a marked reduction, during the second season, in the size and strength of the plant and in the quality and quantity of the fruit. By the third spring the canes make only a feeble growth, if any, and the plants frequently die during the following summer or winter. The average period elapsing between the first symptoms of the disease and the death of the canes seems to be two to three years. Recovery has in no case been observed.

Affected plants show a peculiar curling of the upper leaves, especially on the young, rapidly growing shoots. The margins and veins do not arch downwards as in 'yellows', but the midribs of the leaflets are hooked or recurved. A uniform mottling of the affected leaves, extremely faint and scarcely noticeable in the early stages and due to the presence of small, scattered, yellowish-green areas, usually accompanies the disease. In the Dover-Avon district of Ohio, where these investigations were chiefly carried out, a deep violet-blue discoloration of the stems of shoots is a constant symptom of the disease. This discoloration, which is confined to the green chlorophyll layer of the stem, appears in the form of dots or longitudinal stripes resembling pencil marks, irregularly placed and often confluent. It occurs commonly at or near soil-level, extends upwards on the stem to a height of 2 ft. or more, and is also found near the bases of lateral branches. On fruiting canes of diseased plants the petioles and stems of lateral branches often show short, narrow, longitudinal streaks of brown or purplish-brown. In some localities the blue discoloration, which is of great assistance in the detection of the disease, is unfortunately altogether absent. No abnormality of the root system has been observed.

Eastern blue-stem appears to be a strictly systemic disease affecting all the shoots. It is readily transmitted by planting suckers or tips from affected plants, even though they may show no symptoms. Diseased plants cut off at the ground after harvesting throw up young shoots which soon show typical symptoms. The term 'eastern blue-stem' is used in order to distinguish the disease here described from a parasitic disease of black raspberries in Washington, known locally as 'blue-stem'. It must also be distinguished from 'yellows', a term applied to the forms of mosaic and leaf curl diseases described by Rankin and others [see this *Review*, i, p. 218; ii, p. 17]. Apart from symptomatic distinctions, the host-range of eastern blue-stem differs from that of 'yellows', the former attacking only black raspberries [*Rubus occidentalis*] and, probably, blackberries, while the 'yellows' type of leaf curl affects red raspberries [*R. idaeus*], 'purple canes', the Japanese wineberry (*R. phoenicolasius*), and two varieties of black raspberry, the Cumberland and Hoosier. Of the four varieties of black raspberry grown commercially in the Dover-Avon district, the Hoosier appears to be the most susceptible, Cumberland and Plum Farmer are also seriously affected, while Kansas is the most resistant, though no variety has been found to possess a really high degree of resistance.

The characteristic deformity and mottling of the leaves, the stunting and gradual death of the plants, and the transmission of the disease to vegetative progeny, all indicate that the disturbance

is of the mosaic type. Microscopic examination has failed to reveal the presence of fungi or bacteria, while there is evidence to show that neither environmental factors nor exhaustion as a result of protracted vegetative propagation are primarily responsible. Infection spreads rather slowly to other plants in the field, the means of dissemination being unknown. All attempts at artificial transmission have given negative results. The disease has been known to spread over distances of 200 to 300 yards. It has been observed to spread most rapidly in fields making vigorous growth, coming to a standstill with the cessation of active development. New infections are most frequent on tender, succulent plants.

The disease may be controlled to some extent by thorough and repeated roguing, by the immediate elimination of infected plants in young fields, and by the planting of disease-free nursery stock at as great a distance as possible from affected plantations. Selection experiments have been started with a view to securing resistant strains of commercial varieties. The application of fungicides appears to be useless.

SMITH (E. H.) & PHILLIPS (E. H.). **Studies of the so-called 'smut' of white Fig varieties.**—*Monthly Bull. Dept. Agric. California*, xi, 10, pp. 755–758, 3 figs., 1922.

'Smut' in dried figs is characterized by the appearance of a black, powdery mass in the pulp of the fruit, the mass being composed of spores of the fungus *Aspergillus* (*Sterigmatocystis*) *niger*. On squeezing affected fruits, a black cloud of spores is ejected from the eye end. Badly smutted figs can be picked out by the dark translucent appearance of the skin, but those slightly affected only show dark or yellowish spots in the pulp, with no external evidence of disease, and thus may reach the market. The loss is considerable both from culls and from the inferior quality of the packed fruit. All the white varieties of figs are affected, Adriatics perhaps most abundantly.

On green figs the rot is characteristic, starting round the eye and affecting both the skin and pulp. The tissues become dirty white to slightly pinkish in colour, remaining at first fairly firm in texture but later developing a cheesy consistency. The surface of the skin is usually clean, but a dense growth of white mycelium develops in the pulp and this finally produces masses of spores lining pockets in the interior of the fruit. In late infections the spores are formed earlier and the pulp only is affected.

Inoculations were carried out at Fresno, California, in August and September, 1921, on figs classified into ten types according to the various stages of ripening, with the object of finding out when and in what manner infection took place. Thirty inoculations were made on the trees for each of the younger stages (2 to 8), while for the older stages (7 to 10) ten of each stage were inoculated by cutting the fruit in half, placing spores inside, pressing the halves together and incubating in uncovered dishes in the laboratory. Adriatics were used throughout, together with Kadotas and Calimyrnas for the younger stages, the last-named giving inconsistent results probably on account of 'souring' which affected the trees and was found in every case to check the

development of smut. Controls in the experiments on the trees remained sound.

The results may be summarized as follows. On very hard, green figs, the fungus made a start but only developed slowly. The earliest stage of natural infection appeared to be when the fruit was ripe but unshrivelled, ready for marketing fresh (stage 5). Development was most rapid in stages 4 and 5; it was uncertain in later stages when the fig was beginning to dry out: and in the latest stages, when the pulp had become dry and translucent, the spores could not be made to germinate.

Examination of the figs in the plantations showed that the rot had started in many cases as a small spot under the eye when the fruit was ripe for marketing fresh. Cultures were obtained from many sound figs at this stage, an occasional fig being found infected at a slightly younger stage, whilst figs still younger gave negative results.

The disease appears to be disseminated by insects rather than wind; ants, fruit flies, and beetles are able to make their way into green figs with closed eyes. A premature rain in 1921, however, was observed to favour the disease on trees when smut was well under way.

'Bunchy Top' disease in bananas—interesting experiments.—*Queensland Agric. Journ.*, xviii, 4, p. 307, 1922.

The owner of a plantation at Murwillumbah claims to have discovered a remedy for 'bunchy top' of bananas. In 1920–21 sulphur was applied at the rate of 8 cwt. per acre, together with 'island fertilizer'. This was followed in 1922 by the application of 8 to 10 cwt. per acre of a mixture known as 'basic super', containing 45 per cent. lime and 17 per cent. phosphoric acid. In some cases this mixture was applied round the stools to a radius of 3 or 4 ft., in others the whole surface was treated, the suckers being also well dusted with the mixture before planting. All the suckers were taken from 'bunchy top' stock, but of the 800 planted since April not one has so far contracted the disease. The stems are strong, the colouring of the foliage excellent, and the growth of the plants exceptional. Old diseased stalks similarly treated are now throwing out vigorous centre leaves.

It is believed that the previous application of sulphur rendered the phosphates readily available to the plants, in addition to its action as a fungicide in the soil.

Ludwigs. **Versuche mit 'Solbar'.** [Experiments with 'solbar'.]—*Deutsche Obstbauzeit.*, lxviii, 21–22, p. 213, 1922.

The results of trials of the proprietary fungicide 'solbar' carried out by fruit-growers and horticulturists in Brandenburg during 1921, at the request of the local Chamber of Agriculture, are summarized. The fungicide was applied at the recommended summer strength of 1 per cent. Although the tests covered too short a period to furnish definite data, the preliminary results are regarded as satisfactory on the whole. Apple mildew [*Podosphaera leucotricha*] was successfully combated in five instances, which included the susceptible varieties Landsberger Renette and Cox's Orange.

Good results were also obtained against American gooseberry mildew [*Sphaerotheca mors-uvae*], rose mildew [*S. pannosa*], vine mildew (*Oidium tuckeri*), and the mildews of *Euonymus japonica* and *Delphinium*. Used against *Fusicladium* and *Monilia* of fruit trees solbar gave conflicting results, no improvement being remarked in some cases while in others the diseases were entirely checked. In one case the leaf mould or 'rust' disease of tomatoes (*Cladosporium fulvum*) was eradicated by two sprayings with solbar. Fungous diseases [unspecified] of cucumbers were also successfully treated in a suburb of Berlin. In an experiment conducted by the Potato Research Institute at Steglitz, the percentage of scab [*Actinomyces scabies*] in tubers from 'seed' treated with 5 per cent. for 30 minutes was only 8, as against 28 in tubers from untreated 'seed'.

SALMON (E. S.) & WORMALD (H.). **Hop 'canker' or 'growing-off'.**—*Journ. Min. Agric.*, xxix, 4, pp. 354–359, 2 figs., 1922.

The cause of hop canker or 'growing-off' (the latter being the descriptive name under which the disease is known in many districts of the Weald of Kent and of Sussex) was attributed by Percival (*Journ. S.E. Agric. Coll. Wye*, xi, pp. 87–89, 1902) to *Fusoma parasiticum*. The disease causes a wilt of one or more bines at each affected 'hill'. The wilted bines are usually found to be almost severed at the base and easily come away from the root-stock with a slight pull. The underground root stock is affected by a canker, the infected portions being brown and dead. The diseased bines examined by the authors, the basal parts of which had been dead for some time, were often found to bear white pustules of a fungus, with conidia of the *Fusarium* type. Bines just beginning to wilt sometimes did not show these pustules, but usually the mycelium of a fungus was to be found in the discoloured tissues of the bark and of the wood, and in cultures made with particles of such tissues on sterilized media, the fungus grew out and eventually gave rise to *Fusarium* fructifications. This evidence that the latter was the organism responsible for the disease was strongly supported by successful inoculation experiments carried out by the authors on hop sets, although the results were not quite conclusive, owing to the fact that some of the control sets also contracted the disease.

Hop canker seems to be favoured by moist soil conditions, and the general experience of hop-growers is that the disease is worse in a wet season or following a wet winter, and that the hills are likely to be more severely attacked on wet, clayey patches or in shaded parts than on lighter soil or in portions of the garden more exposed to sunshine.

Some varieties of hops appear to be more susceptible to the disease than others; among the more resistant the authors mention the varieties Fuggles, Cobbs, and Old Golding.

Direct preventive measures consist in hard 'cutting' or 'dressing' of all the hills in the affected parts of the gardens, all the brown parts of the root stock being pared away, and in the grubbing up and destruction of all dead plants. Drainage or cultivation to

remove the moisture of wet land, or letting in the sun, appear to have a favourable effect in keeping the disease in check.

DUGGAR (B. M.). **The sizes of the infective particles in the mosaic disease of Tobacco.**—*Ann. Mo. Bot. Gard.*, viii, pp. 343–356, 1921 [1922].

By arranging a series of porous filters of different degrees of permeability the author sought to determine the two adjacent members of the series, one of which would freely allow the virus of tobacco mosaic to pass while the next would stop all but a small quantity of it.

These two were found to be a Livingston spherical atmometer cup and a cylindrical atmometer tube. The former was of a type found by experiment invariably to prevent the passage of the vegetative cells and spores of *Bacillus subtilis* and to be finer than the Mandler diatomaceous filter. The cylindrical atmometer tube was still finer.

The juice to be filtered was prepared by a standard method and the wetted filters were lowered into a vessel containing it, every precaution being taken to avoid accidental contamination. The filtrate was sucked into the filter at a reduced pressure of one-fifteenth to one-thirtieth of an atmosphere, about fifteen minutes being required to obtain sufficient for testing in the case of the spherical cup and 30 to 45 minutes in the case of the cylindrical tube.

The filtrate was then tested for the presence of the virus by inoculating rapidly-growing tobacco plants through wounds. In the two series reported, eighteen out of twenty plants inoculated with the filtrate from the spherical cup got mosaic within eighteen days and only one of those inoculated from the tube, in one case, and nineteen and five respectively in the other.

It was concluded that the size of the infective particles must lie between the pore sizes of the two filters mentioned, probably close to that of the cylinder. Subsequent tests indicated that the pore sizes of these two filters were sufficiently close together to obviate the necessity of seeking for an intermediate size. Tests with milk and dextrin showed that the size of the infective particles was greater than that of the colloidal particles of dextrin, but less than that of casein. Haemoglobin was selected as having particles of intermediate size. The haemoglobin colloidal solution was freshly prepared by a standard method and was found to behave just like the tobacco mosaic virus, passing freely through the spherical cup and only in very small quantity through the cylinder. It was also found that the spherical cup allowed approximately 50 per cent. of the gelatin particles from a 1 per cent. solution of gelatin to pass.

From these experiments the author states that it seems clear that with approximately equal pressures and equal time intervals the infective particles of mosaic tobacco juice have about the same capacity to pass porcelain filters as the colloidal particles of freshly prepared haemoglobin. They have apparently a greater capacity for filter passage than 1 per cent. gelatin particles. As the particles of gelatin are not apparently very much larger than those of haemoglobin the conclusion that the virus particles are about the size of the latter is strengthened.

Bechhold has indicated that haemoglobin particles are 33 to 36 $\mu\mu$ [0·033 to 0·036 μ] or less than one-thirtieth of the breadth of the majority of bacterial parasites of plants. If the infective particles of tobacco mosaic are of the same order of size as colloidal haemoglobin particles they are evidently very different from the known bacterial plant pathogens.

SMITH (K. M.). **Mosaic disease in plants.**—*Nature*, cx, 2768, p. 668, 1922.

The writer records the discovery, in potato plants affected with mosaic, of the invariable presence, in some of the cells of the mosaic tissue, of an abnormal body in close association with the nucleus; this body is definitely connected with the disease and is apparently similar to the peculiar body of amoeboid appearance which was described in the cells of mosaic diseased maize by L. O. Kunkel in 1921 in Hawaii [see this *Review*, i, p. 194]. No attempt is made at present to define the nature of this body.

RAMSBOTTOM (J.). **Orchid mycorrhiza.**—*Trans. Brit. Mycol. Soc.*, viii, 1 & 2, pp. 28-61, 6 pl., 1922.

The author reviews the work so far done on mycorrhiza, especially in orchids, and discusses the fungus-root association in *Gastrodia*, Ericaceae, Pyrolaceae, Burmanniaceae, and Gentianaceae. The endotrophic mycorrhiza of orchids is described and figured from photo-micrographs taken from preparations made by the late Mr. J. Charlesworth, whose success in the germination of orchid seeds by inoculating them with pure cultures of the appropriate fungus on a large scale is stated to have been remarkable. The method employed in using the cultures is described. In discussing the germination of orchid seeds in the absence of fungi, Noël Bernard's experiments with solutions of increasing concentrations of salep and sugar are referred to, and cases in which concentrated nutrient solutions can replace the fungus are mentioned. It is recalled that Bernard found that the *Rhizoctonia* of these mycorrhiza has the power of increasing the concentration of the nutrient medium, and this stimulation of autonomous germination by concentrated solutions is compared with the activation of certain eggs by various substances in the absence of fertilization.

With reference to the enormous number of seeds produced by orchids, the writer believes that it is in some way related to the distribution of the endophytic fungus in nature. A general survey of families of plants in which endophytic mycorrhiza are typically developed shows that it is the rule for them to have small seeds, ill-adapted for germination; this suggests that in families adapted to a mycorrhizal habit there is a tendency for the seeds to become dependent upon the fungus for successful germination, whilst there is a correspondingly greater production of seed. The writer advances the hypothesis that saprophytism has arisen by the mycorrhizal fungus taking over some of the functions necessary in germination and relieving the flowering plant of the need of excessive food production for the developing seed and thus of the necessity for carbon assimilation.

In reviewing the various theories which have been put forward

to account for the fungus-root association, the author thinks that, referring only to orchids, it seems most reasonable to regard the condition as having arisen from parasitic attacks by the fungus. The ability of the fungus to transport nutrient solutions has been made use of by the flowering plant, which has turned the tables on the aggressor and ended by making use of the latter for its own needs. The facts at present known, however, are insufficient to decide between the various theories in regard to the origin and significance of mycorrhiza.

FIROR (J. W.). **Pecan rosette.**—*Bull. Georgia State Coll. Agric.*, x, 19, 12 pp., 4 figs., 1922.

The present paper antedates by several years the most recent work on pecan rosette, its publication having been delayed by war conditions. Hence Rand's view that the disease is an infectious chlorosis [see this *Review*, i, p. 440] is not taken into account. The writer regards rosette, which is extremely prevalent in Georgia, as a physiological disturbance caused by the inability of the root system of certain pecans to adapt itself to unfavourable soil conditions. Among the latter are mentioned lack of water-holding capacity; rapid leaching or evaporation of soil water during the growing season; shallow soils, especially with a hard pan in the sub-soil; and lack of suitable plant food.

In 1916–17 a block of forty-three Stuart pecan trees at Louisville, Georgia, was mulched with pine straw, the mulch remaining on the ground till the spring of 1919. In 1915 this block had eight trees free from rosette, fifteen rosetted without dead twigs, and twenty rosetted with dead twigs; in 1919 forty of the trees were completely healthy, while the remaining three showed symptoms of rosette without dead twigs. Thus there was an improvement of 400 per cent. in the incidence of the disease amongst the trees in the mulched block. In an untreated control block the conditions of the trees remained stationary during the period under review.

Before applying the mulch, the trees should be well fertilized with stable manure or 5 to 25 lb. per tree of a mixture containing 10 per cent. phosphoric acid and 4 per cent. nitrogen. In orchards comparatively free from the disease, the cultivation of heavy crops of field peas and other legumes will probably eliminate rosette without further treatment.

DUFRÉNOY (J.). **Sur la tuméfaction et la tubérisation.** [On tumefication and tuberization.]—*Comptes rendus Acad. des Sciences*, clxxiv, pp. 1725-1727, 3 figs., 1922.

The formation of tumours, which is accidental and pathological in most plants, may be habitual in certain species. Thus in various species of *Eucalyptus* the collar of the seedling is always distended by proliferation of the axillary buds of the cotyledons and of the first leaves, which, in fusing, unite with the first internodes of the stem, the hypocotylary axis, and the base of the root. A tubercle is thereby formed which is provided with roots and numerous buds, and which buries the lower stem internodes in a mass of woody parenchyma, with wide medullary rays separating bundles

of twisted fibres. Similar tubers occur at the base of arborescent Ericaceae.

Nodules appear below the collar of most of the young *Arbutus unedo* trees of the Piñada d'Arcachon, and increase in size with the development of the tree. On its distended base the mature tree forms vigorous branches. The cause of the distensions is obscure; in the cambium and phelloderm of the tumours of *Arbutus* bacteria were occasionally found, but they did not develop satisfactorily in the media tried by the author.

The swellings do not appear to be essential to the life of the plant. They are not invariably found on *Arbutus*, and seedlings grown under aseptic conditions form cotyledons though no hypertrophy occurs.

In the autumn and winter these tumours accumulate in their hypertrophied and hyperplasied medullary rays large quantities of starch. Thus they possess the anatomical and physiological characters of tubers, and present an example of transition between tumefication and tuberization.

JONES (L. R.). **Experimental work on the relation of soil temperature to disease in plants.**—*Trans. Wisconsin Acad. Sci., Arts & Lett.*, xx, pp. 433-459, 4 figs., 5 pl., 1922.

The primary purpose of the present paper is to explain what is essentially a new method of attack upon a group of phytopathological problems, aimed, broadly stated, at gaining a clearer understanding of the relation of environment to the occurrence of disease in plants. In an attempt at putting the work upon an experimental basis, the relation of soil temperature to certain cases of soil parasitism has been selected because of simplicity of definition and practicability of attack, and for the sake of illustration the author briefly summarizes the results so far obtained in the work at Madison by means of the now well-known Wisconsin constant temperature soil tanks, on the *Fusarium* wilt of the tomato, the potato stem canker caused by *Rhizoctonia solani*, and the root rot of tobacco due to *Thielavia basicola*.

It is evident that this work has already defined problems which are distinctly physiological rather than pathological. Each disease results from the vital inter-relation of two organisms, the parasite and the host, both of which are affected by variations in soil temperature. The latter also induces concomitant variations in soil moisture, aeration, and other factors, though these can be eliminated, in great part, by the apparatus used. It is recognized that the methods of investigation employed cannot give all the data necessary for an interpretation of the biological principles involved sufficiently full to account for the influence of the environment on these diseases under natural conditions. Out of the mass of complex and inter-related problems only a few of the simplest have as yet been attacked. The assistance of the physiologist is required for the study of such matters as the relation of soil temperature to the rate and character of root development, the correlation between soil and air temperatures as affecting the extent and type of development of root and shoot organs, the relation of soil and air temperatures to the nutritive and reproductive processes, and consequently the

proper correlation of these with the natural sequences in the plant's development, &c.

There are, however, some distinctly pathological problems for the development of which plant pathologists cannot wait for the help of others. Such are the questions of the evident and immediate influence of soil temperature and other environmental factors on the occurrence, severity, and geographical distribution of certain introduced parasites, and also the question of the relation of environment to disease resistance. The author is convinced that plant pathologists must continue to inquire with increasing precision into the relation of environment to disease development. Not only must they give to these problems some of their own best efforts, but they must seek the assistance of special workers in the related fields, physiologists, ecologists, geneticists, and plant culturists. Working thus in a spirit of correlation and co-operation, the author believes that prompt and important progress is assured, and the results already obtained [cf. this *Review*, i, pp. 243, 281, and ii, pp. 67, 76] amply justify this belief.

Jones (L. R.), McKinney (H. H.), & Fellows (H.). **The influence of soil temperature on Potato scab.**— *Wisconsin Res. Bull.* 53, 35 pp., 9 figs., 1922.

In comparing the very general prevalence and serious nature of common potato scab [*Actinomyces scabies*] in America with the situation in northern Europe, where the disease is usually of minor importance in spite of the highly intensive cultivation of potato and the abundant use of stable manure from animals fed on cull potatoes, the conclusion was reached that the development of scab must evidently be influenced by different environmental factors. Various reasons suggested that the temperature of the soil might be particularly important. The results of five series of experiments in greenhouses, using the 'Wisconsin temperature tank' method with seven gradations of soil temperature ranging from about 11° C. to 30·5° C., all other soil and air conditions (including moisture) being kept alike and approximately constant throughout each series, show that such is the case. The same strain of the parasite was used throughout, and the disease developed at all the soil temperatures used but was comparatively slight at both extremes. The optimum temperature under the conditions of the experiments is considered by the authors to lie at about 22° C., this being near the mean between the optimum (23° C.) as measured by the number of scabby tubers and the optimum (20·5° C.) as indicated by the total tuber surface scabbed. A preliminary field trial in 1919, in which three gradations of soil temperature, roughly 19°, 21°, and 25° C., were maintained in small plots by special apparatus, showed that the amount of disease increased with the temperature, the percentage of scabbed tubers being 6·25, 13·23, and 30·55 respectively.

Field observations made both in Europe and America seem to agree generally with these experimental results; they indicate that the disease is more prevalent in regions having warm growing seasons than in regions with cool summers, and that a greater amount of scab seems to develop in a given locality during a warm season than during a cool one. An examination of the weather

records of the leading Wisconsin potato-growing districts showed that the mean air temperatures for July and August during the hottest seasons (when scab is most prevalent) approximate to the optimum soil temperature range for scab obtained in the experiments.

The influence of soil temperature on the disease must obviously be considered in relation to its effects both upon the parasite and upon the host. There are indications that the stimulating influence of comparatively high temperatures on the prevalence of the scab organism in the soil is cumulative from season to season, whereas the influence upon the host is immediate and temporary. The data obtained by the authors indicate that the temperature optimum for scab lies between that for the growth of the parasite in pure culture (from 25° to 30° C.) and the definitely lower optimum for the rate of tuber development, being somewhat closer to the latter. It must, however, be noted that the influence of soil temperature on the different organs of the potato plant is not uniform, and that it varies also with the stage in their development; exact data are not yet available on these points. The evidence at hand suggests that rapidly growing tubers scab more severely than slow growing ones, and that there may be certain differences in the chemical composition of the tubers developing under different conditions that may influence their relative susceptibility to infection. On the whole the immediate relation of temperature to the development of scab seems to be more closely correlated with its influence upon potato tuber development than with that upon the growth of the parasite.

MILLARD (W. A.). **Common scab of Potatoes.**—*Ann. Appl. Biol.*, ix, 2, pp. 156–164, 2 pl., 1922.

Common scab of potatoes [*Actinomyces scabies*], though ubiquitous in England, occurs in a virulent form only in certain circumscribed localities, such as some districts of Yorkshire, where the crop is often so severely scabbed as to be practically unsaleable. Farmers have been obliged in some cases to stop growing potatoes on land which is otherwise eminently suitable for their cultivation.

The symptoms of the disease are fully described. Mature scabs vary considerably in general appearance, some having a pitted aspect owing to the depression which is formed in the early stages of the disease never becoming filled in by the subsequent development of cork, while in other cases the scab stands out above the surface of the tuber in knob-like, corky projections. These two forms represent the chief types of the disease when it occurs in its most virulent form. In Britain, however, the commonest form is intermediate between the two extremes; it is slightly raised and is also characterized by an irregularly concentric series of wrinkled layers of cork arranged around a central core or depression.

The author isolated ten strains of *Actinomyces* from scabbed potatoes. These showed considerable variations one from another from the beginning, and further variation was found to result from differences in the culture media, age of the cultures, and the like. Still, in view of the absence of a clearly defined limitation of the

species *A. scabies*, all the strains isolated were regarded as belonging to this species provided that they were capable of inducing scab.

Inoculations showed that five out of seven of the strains tested caused scab, the negative results with the other two being perhaps due to early ripening of the potato varieties inoculated in these two cases.

It is considered that common scab can be caused by various strains of *Actinomyces*, but further work is required to decide whether they should all be regarded as forms of a single species.

STEVENS (H. P.). **Sodium silicofluoride as a mould preventive.** *Bull. Rubber Growers' Assoc.*, iv, 5, pp. 227–228, 1922.

Further tests in mould prevention [see this *Review*, i, p. 263] indicated that sodium silicofluoride in the proportion of 1·8 gm. to 3,000 cc. of latex prevents all but the slightest traces of mould developing in sheet rubber during transport. Samples treated with only 0·6 gm. to the same quantity of latex (i.e. 0·02 per cent.) arrived in a mouldy condition, so that this quantity is evidently insufficient. The figures for the breaking strain and rate of cure of the samples treated with sodium silicofluoride are satisfactory, though slightly below the average.

SUNDARARAMAN (S.). **Helminthosporium disease of Rice.** *Agric. Res. Inst. Pusa Bull.* 128, 7 pp., 4 pl. (2 col.), 1922.

During 1918–19 the rice crops in the deltaic tracts of Godaveri and Kistna, Madras, were severely attacked by several pests and diseases, including leaf spot caused by *Helminthosporium*. The latter occurred principally in badly drained fields that were flooded by unusually heavy rain while the ears were forming. Spots appeared on both sides of the leaves, leaf-sheaths, and glumes. These spots measured 1 to 14 by 0·5 to 3 mm., and had brown centres with smoky black patches formed by a growth of dark brown, septate hyphae and spores. As they increased in size they frequently merged, discolouring the entire area of the leaf.

The development of the parasite is promoted by continuous heavy rain and by cloudy, close weather. Under such conditions the disease spreads rapidly from one plant to another. The nodes are sometimes attacked towards maturity and blackened with a dense growth of conidia and conidiophores. The surface of the glumes may also be covered with a black, fluffy mass of conidia and conidiophores, the grains within being shrivelled and discoloured. Generally, however, the grains and other parts of the ear are not affected.

The mycelium in the leaves consists of numerous, septate, hyaline hyphae passing from cell to cell. Dark brown conidiophores, 70 to 175 by 5·6 to 7 μ, emerge from the stomata and epidermal cells and bear the spores on knee-shaped projections. Spores are found only on old, mature spots and are few, deep olive brown in colour, with 5 to 10 septa, 45 to 106 by 14 to 17 μ, and falcately sigmoid in shape. These measurements do not agree with those of *Helminthosporium sigmoideum* or *H. macrocarpum* previously known on rice. *H. oryzae* Miyabe & Hori has been recorded on rice in Japan,

but the author has not seen a description of it [see this *Review*, i, p. 414].

The fungus was isolated and grown in pure culture on rice agar and other media. In culture the conidiophore bears several conidia, formed successively, near the top [up to 8 are figured]. Germination is generally from the end cells. Inoculation experiments on the leaves, leaf-sheaths, and ears confirmed the field observations that the fungus is a weak parasite under normal conditions, the spots formed being limited in size. A serious reduction of yield on account of this disease is scarcely to be feared in ordinary seasons.

SUTCLIFFE (H.). **Disinfectants. Abridged report by the [Rubber Growers' Association] scientific staff in Malaya.**—*Bull. Rubber Growers' Assoc.*, iv, 5, pp. 224–227, 1922.

Three new disinfectants, 'Superol', 'Parakol', and 'Rustikol', and a modified insecticide, 'Solupar', have been tested for their fungicidal efficiency. The method of testing was the same as that described in previous reports (a culture medium was prepared containing 2 per cent. bovril, 2 per cent. glucose, and 6 per cent. agar, and to this was added enough of a 25 per cent. solution of the substance to be tested to give concentrations of 10, 5, and 2 per cent. For lower concentrations weaker solutions of the fungicide were used). In the present case the fungus used was a pure culture of a *Gloeosporium* isolated from dead *Hevea* branches.

'Parakol' was found to be a very good disinfectant, only giving a growth equal to the control at a concentration of 0·063 per cent. after ten days; owing to its deep green colour it would be useful in daily painting against black line canker [*Phytophthora* sp.]. 'Rustikol' is also a good disinfectant (growth equalled control in eighteen days at 0·004 per cent. concentration), suitable for treating wounds or painting the cut ends of roots or branches. 'Superol' is very similar to 'Chinosol', a clear yellow solution with a strongly acid reaction. It gave a growth equal to the control in thirty-three days at 0·008 per cent. 'Solupar' containing 1 per cent. carbolic acid was efficient at a strength between 10 and 15 per cent. Owing to the absence of material it has not been possible to test 'Solupar' as an insecticide, for which it is primarily intended.

JARVIS (E.). **Cane pest combat and control.**—*Queensland Agric. Journ.*, xviii, 4, pp. 277–279, 1922.

On the Herbert River in Queensland the most serious disease of sugar-cane appears to be the gumming disease caused by *Bacillus vascularum*. It is found chiefly in the most commonly grown variety, Clark's Seedling (H. Q. 426) but the Badila cane appears to be becoming increasingly susceptible. The variety H. Q. 409 is practically immune, but is unpopular because of its slow growth and tendency to arrow early and profusely. The chief factors which predispose to gumming are poor drainage, an impervious subsoil two or three feet from the surface, defective cultivation, and a heavy rainfall. Of these, bad drainage appears to be the most important. Little or no attention is paid to the selection of healthy

canes for 'seed' purposes. The planting of sound setts and burning the trash are recommended.

LEE (H. A.) & KOPKE (E. W.). **Mosaic disease of Sugar-cane in the Philippines.**—*Philipp. Agric. Rev.*, xiv, 4, pp. 418–421, 5 pl. (1 col.), 1922.

Yellow stripe or mosaic disease was first observed in the Philippine Islands by Lyon about 1910 or 1911 and has since been reported from a number of districts.

A brief and admirably illustrated description of the symptoms of the disease is followed by a discussion of the losses, which in the Cebu Purple variety may amount to 20 per cent. Severe stunting also occurs in the H-109 and Yellow Caledonia varieties, though the latter is not often attacked, while the stunting of D-1135 is slight. The Japanese forage canes, Uba, Zwinga, &c., are immune from mosaic, but their sugar production is very poor, and their use in the Philippines is hardly to be recommended at present. The first and most essential step in the control of the disease is the selection of healthy setts for planting.

WELLES (C. G.). **A provisional list of the parasitic fungi of the Philippine Islands.**—*Philipp. Agric. Rev.*, xv, 2, pp. 149–202, 1922.

This list of the parasitic fungi known in the Philippine Islands up to 1922 contains about 260 genera and 958 species. A complete host index is appended.

DOIDGE [E. M.]. **South African Ascomycetes in the National Herbarium. Parts I & II.** *Bothalia*, i, 1, pp. 5–32, & 2, pp. 65–82, 8 figs., 1922.

These papers deal with collections of South African fungi preserved in the National Herbarium at Pretoria. The groups here considered contain a large proportion of parasitic forms, chiefly on leaves; some eighty-five species are mentioned, of which thirty-five are new. The species are either fully described, or their former descriptions are enlarged and amended following the examination of further material. The nomenclature and classification follows the recent work of v. Höhnel, Theissen, and Sydow. Four new genera are proposed, and one old genus is shown to be superfluous. *Dielsiella* was originally erected for those species of *Cycloschizon* whose spores become brown, but this is now shown to be characteristic of *Cycloschizon* itself, and so the former genus disappears. Of the new genera three belong to the group Polystomellaceae. *Macowaniella* [*M. congesta* (Wint.) Doidge on *Carissa arduina*] differs from *Hysterostomina* in the presence of free mycelium, and from *Lembosiodothis* in the absence of subcuticular bands. *Isipinga* (*I. areolata* n. sp. on *Euclea natalensis* and *I. contorta* Doidge on *Trichocladus ellipticus*) differs from *Hysterostoma* in the presence of well-developed acrial mycelium, and from *Asterodothis* in the absence of a central column or foot. *Palawaniella* (*P. eucleae* n. sp. on *Euclea macrophylla*) differs from *Palawania* chiefly in the centripetal development of the stromata, and in the epidermal, rather than sub-epidermal, hypostroma; and from *Pleiostomella* in the

brown, two-celled spores, and loculi less definitely arranged in rings. Among the Stigmataceae, *Parastigmatea* (*P. nervisita* n. sp. on *Stephania hernandifolia*) only differs from *Stigmatea* in its spores being hyaline and continuous.

VAN DER BIJL (P. A.). **A Host list of the Polyporeae occurring in the Union of South Africa.**—*Kew Bull. Misc. Inform.* 6, pp. 177–182, 1922.

The author cites as parasitic the following species, only those hosts being noted here which are stated to be living.

Polystictus spp. are included under *Polyporus*.

Fomes applanatus (Pers.) Gill. [including *F. annularis* Lloyd, *F. leucophaeus* (Mont.) Cke, *F. vegetus* (Fr.) Cke, *F. australis* (Fr.) Cke] on *Olea laurifolia*; *F. conchatus* (Pers.) Gill. on *Melia azedarach*; *F. connatus* (Weinm.) Gill. on *Curtisea faginea*; *F. geotropus* Cke on *Ocotea bullata*, *Podocarpus* sp., and *Virgilia capensis*; *F. rimosus* (Berk.) Cke on *Acacia* sp., *Curtisea faginea*, *Elaeodendron croceum*, *Kiggelaria africana*, *Olea laurifolia*, *Pleurostyla* sp., *Ptaeroxylon utile* (a heart rot), *Rhus laevigata*, *Schotia latifolia*, *Scolopia mundtii*, and *Xymalos monospora*; *F. senex* (Nees & Mont.) Cke on *Sizygium* sp.; *F. yucatensis* (Murr.) Sacc. & D. Sacc. on *Olea* sp. and *Trema bracteola*.

Lenzites betulina (L.) Fr. (including *L. guineensis* Fr.) on *Celtis kraussiana*, *Olea laurifolia*, *Pinus* sp., and *Quercus* sp.

Polyporus fruticum Berk. & Curt. on Rubiaceous plants; *P. luculus* (Leys.) Fr. (including *Ganoderma sessile* Murr., *P. capensis* Lloyd, and *Ganoderma fulvellum* Bres.) on *Acacia* sp., *A. mollissima*, *Albizzia amara*, *A. fastigiata*, *Olea laurifolia*, *O. verrucosa*, and *Salix* sp.; *P. patouillardii* Rick on *Scolopia mundtii*; *P. sanguineus* (L.) Fr. on *Aloe arborescens* and *A. marlothii*; *P. sulphureus* (Bull.) Fr. on *Quercus* sp. (a wound parasite); *P. versicolor* (L.) Fr. on *Prunus persica* (a wound parasite).

Trametes inconulita Fr. on *Ptaeroxylon utile*; *T. obstinatus* Cke on *Acacia mollissima*, *Acacia* sp., *Citrus*, and a number of undetermined hosts; *T. subflava* Lloyd on *Celtis kraussiana*.

BUBÁK (F.). **Une nouvelle espèce du genre Urocystis.** [A new species of the genus *Urocystis*.]—*Bol. R. Soc. Esp. Hist. Nat.*, xxii, 4, pp. 205–207, 2 figs., 1922.

A fungus found on *Lolium perenne* near Algodor, in the Province of Toledo, Spain, in 1921, and sent to the author by Gonzalez Fragoso with the suggestion that it might be a new species of *Urocystis*, was compared with *U. occulta* and *U. agropyri*. It resembles the former in attacking the stems, leaf-sheaths, leaves, and spikes with the result that poor spikes are formed, or none at all, but the spore balls often contained 4 or 5 central spores instead of 1 or 2, seldom 3 or 4, as in *U. occulta*. The spores of the *Lolium* fungus were also slightly more flattened and considerably smaller (9 to 16 by 9 to 13·5 μ). The peripheral cells usually covered the whole surface of the spore ball, which is not the case with *U. occulta*, where the surface is dotted with isolated peripheral cells, having larger dimensions (7 to 16 as against 6 to 11 μ), a thicker membrane (2 as against 1 μ), and a smaller lumen.

The chief differences from *U. agropyri* are the larger and more complex spore balls, smaller and darker central spores, and smaller and more flattened peripheral cells. The spore mass is also darker than that of *U. agropyri* on the same host plant, while the latter is restricted to the leaf sheaths and leaves, and grasses attacked by it never produce stems.

The new fungus is named *Urocystis bolivari* Bubák & Fragoso, and a Latin diagnosis is given.

United States Department of Agriculture, Federal Horticultural Board, Service and Regulatory Announcements, January to June, 1922, pp. 17–25, 27th October, 1922.

The Plant Quarantine Conference called by the United States Department of Agriculture in May 1922, was attended by Dutch, English, Welsh, and Belgian representatives, as well as by over two hundred prominent American nursery-gardeners and a number of State officials. The primary object of the Conference was to consider whether any modification of regulation 3 of Quarantine 37, which provides for the entry under permit of certain classes of bulbs, stocks, cuttings, scions, and seeds of flowers, fruits, trees, and shrubs into the United States, was desirable. It was also hoped to promote a better understanding of the necessity of safe-guarding the major national crops against the introduction of destructive pests and diseases. At a conservative estimate, the annual loss to American agriculture from imported pests amounts to $2,000,000,000 exclusive of imported bacterial and fungous diseases of plants. Amongst the most serious of the latter are citrus canker [*Pseudomona citri*], which has cost about $2,130.000 for control work since its introduction with Japanese trifoliate orange stock thirteen years ago; pine blister rust [*Cronartium ribicola*] which was introduced from Germany with a consignment of American white pine seedlings, and now threatens to exterminate a forest stand valued at $516,750,000; and potato wart [*Synchytrium endobioticum*] now restricted to parts of Pennsylvania, Maryland, and West Virginia. Chestnut blight [*Endothia parasitica*], introduced with a small shipment of Oriental chestnut trees, has already destroyed half the American chestnut stand. New York and Pennsylvania have suffered the most serious damage, and the disease is now spreading down the Appalachian Mountains to North Carolina and Alabama, and westward into West Virginia. The present stand is valued at $58,000,000. It is stated that no important pest is known to have been imported and become established since the passage of the Quarantine Act in 1912.

A proposal made by the foreign delegates for an international agreement permitting the free movement of plants between countries under inspection and certification was rejected by the Secretary of Agriculture and the Federal Horticultural Board. It was pointed out, *inter alia*, that the United States, with their wide climatic range, would run a far greater risk of permanently accommodating imported pests and diseases than would the northern European countries where atmospheric conditions were adverse to the establishment of such organisms. Moreover, the shipments from Europe into the United States would be out of all proportion to the

exporting capacity of the latter. America would therefore have everything to lose, and little, if anything, to gain by the proposed amendment.

In the report of the advisory committee of the Conference, comprising representatives of Universities and the trade, to the Secretary of Agriculture, the opinion was expressed that no material changes are necessary either in Quarantine 37 or in the regulations of the Federal Horticultural Board for its enforcement. The idea of committees representing the various interests affected by the regulations is commended in the report, as tending to promote a better understanding between the different parties concerned. In view of the serious losses to American agriculture from pests and diseases imported before the establishment of Quarantine 37, the committee declared that much greater care than formerly must be exercised to exclude them.

In reply to certain criticisms directed against Quarantine 37, Dr. C. L. Marlatt (Chairman of the Federal Horticultural Board) pointed out that every facility is given for the importation, by permit or otherwise, of all necessary plant material for food, manufacturing, or medicinal purposes. During the last two years no less than 6,000 open continuing permits have been issued for the introduction of bulbs, fruit and rose stocks, and fruit, forest and ornamental trees, which are not restricted as to quantity. Of the so-called prohibited plants, the number of which permitted entry in any single consignment is controlled, permits authorizing the importation of over twenty-nine million have been issued since 1919. At the same time he states that many European countries have closed their frontiers to corresponding material from America. The fear that European countries will 'retaliate' for the American Quarantine restrictions by closing their doors to American meat and grain exports is, he believes, absolutely without foundation. The free entry into the United States of foreign plants has been the proved cause of incalculable damage, and while its resumption is out of the question, he considers that ample provision is made under the present system for all necessary imports.

An Act to make special provision for the control of the disease of fruit and other trees known as fireblight.—New Zealand, 1922, No. 20, 16th October, 1922.

The 'Fireblight Act' 1922 replaces the previous order of 1921 declaring hawthorn a noxious weed [see this *Review*, i, p. 283] and empowers the Governor-General to declare any specified portion of New Zealand to be a commercial fruit-growing district, and to make regulations prescribing the trimming or cutting down in the manner and at the times specified of all hawthorn growing within the declared district or any part of it. If fireblight exists in the district, the complete destruction of all hawthorn growing therein within a specified time may be prescribed. The carrying out of these orders falls on the occupiers of the land. If an occupier fails to take the prescribed measures, an Inspector under the Orchard and Garden Diseases Act, 1908, or other authorized officer, may carry them out at his expense without releasing him from the penalties which are prescribed for offences against this Act.